DOCUMENT RESUME

ED 063 719 EC 042 231

TITLE	Binocular Visual Acuity of Children: Demographic and Socioeconomic Characteristics - United States.
INSTITUTION	National Center for Health Statistics (DHEW), Rockville, Md.
REPORT NO	DHEW-HSM-72-1031
PUB DATE	Feb 72
NOTE	40p.
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 ($0.45)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Demography; *Elementary School Students; Negro Youth; *Research Projects; *Socioeconomic Influences; Statistical Data; *Visual Acuity; Visual Perception

ABSTRACT

Reported were estimates of the uncorrected binocular visual acuity levels of distance and near for children aged 6 to 11 years in the noninstitutional population of the United States in relation to their demographic and socioeconomic background. A sample of 7,119 children participated in the Health Examination Survey program of 1963-65. Findings indicated that the distribution of uncorrected distance and near binocular visual acuity among white and Negro children was similar. The proportion with defective distance acuity of 20/40 or less was found to increase with age among the white but not the Negro children. Additional findings were that children from the South and West had better binocular visual acuity at distance and near than children from the Northeast and Midwest. Also, visual acuity at distance and near tended to be better among white than Negro children in the Northeast and Midwest but the reverse in the South and West. Children living in rural areas were found to have better visual acuity at distance and near than did their peers living in urban communities. The proportion of children with defective distance acuity was found to increase with parental educational level and/or family income. Tables of extensive statistical data were included in the report. (CB)

ED 063719

VITAL and HEALTH STATISTICS
DATA FROM THE NATIONAL HEALTH SURVEY
Series 11 - Number 112

EC 042 312

NATIONAL CENTER FOR HEALTH STATISTICS
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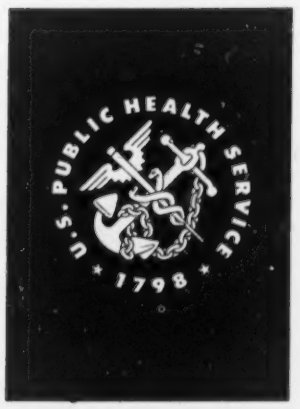
Binocular Visual Acuity of Children:

Demographic and Socioeconomic Characteristics - United States

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration

1

Series 11 reports present findings from the National Health Examination Survey, which obtains data through direct examination, tests, and measurements of samples of the U.S. population. Reports 1 through 37 relate to the adult program; additional reports concerning this program are forthcoming and will be numbered consecutively. The present report is one of a number of reports of findings from the children and youth programs, Cycles II and III of the Health Examination Survey. These reports, emanating from the same survey mechanism, are being published in Series 11 but are numbered consecutively beginning with 101. It is hoped this will guide users to the data in which they are interested.



Vital and Health Statistics-Series 11-No. 112

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Binocular Visual Acuity of Children:

Demographic and Socioeconomic Characteristics - United States

Binocular central visual acuity findings at distance and near without correction for children 6-11 years of age, by race, region, size of place of residence, rate of population change from 1950 to 1960 in place of residence, family income, education of parent, and grade in school.

DHEW Publication No. (HSM) 72-1031

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

Health Services and Mental Health Administration
National Center for Health Statistics
Rockville, Md. February 1972

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COOPERATION OF THE BUREAU OF THE CENSUS

In accordance with specifications established by the National Health Survey, the Bureau of the Census, under a contractual agreement, participated in the design and selection of the sample, and carried out the first stage of the field interviewing and certain parts of the statistical processing.

Vital and Health Statistics-Series 11-No.112

DHEW Publication No. (HSM) 72-1031

Library of Congress Catalog Card Number 72-169287

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SYMBOLS

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BINOCULAR VISUAL ACUITY OF CHILDREN:
DEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS

Jean Roberts and Kenneth R. Duyan, *Division of Health Examination Statistics*

INTRODUCTION

This report contains findings regarding uncorrected binocular visual acuity of noninstitutionalized children 6-11 years of age in the United States by demographic and socioeconomic characteristics, as estimated from the Health Examination Survey of 1963-65.

The Health Examination Survey from which these data derive is one of the major programs of the National Center for Health Statistics authorized under the National Health Survey Act of 1956 by the 84th Congress as a continuing activity to determine the health status of the population.

Three different programs are used in carrying out the intent of the National Health Survey.[1] The Health Interview Survey, in which health information is collected from samples of people by household interview, focuses primarily on the impact of illness and disability upon the lives and actions of people. Through the Health Resources program, health data as well as health resource and utilization information are obtained in surveys of records in hospitals, nursing homes, and other resident institutions and on the entire range of personnel in the health occupations. The Health Examination Survey is the third major program.

In the Health Examination Survey, data are collected by direct physical examinations, tests, and measurements performed on the sample population under study. This method provides the best way to obtain actual diagnostic data on the prevalence of certain medically defined illnesses. It is the only way to secure information on unrecognized and undiagnosed conditions and on a variety of physical, physiological, and psychological measures within the population. In addition, demographic and socioeconomic data are obtained on the sample population under study.

The Health Examination Survey is conducted as a series of separate programs referred to as "cycles." Each cycle is limited to some specific segment of the U.S. population and to certain aspects of health. Data on the prevalence of certain chronic diseases and on the distribution of various physical and physiological measurements and other characteristics in a defined adult population were obtained in the first cycle, as previously described.[2, 3]

For the second cycle, on which this report is based, a probability sample of the noninstitutionalized children 6-11 years of age was selected and examined. This examination primarily assessed health factors related to growth and development. It included an examination by a pediatrician and by a dentist, tests administered by a psychologist, and a variety of tests and measurements by a technician. This survey plan, sample design, examination content, and operation have been described in a previous report.[4]

Field data collection operations for this cycle were started in July 1963 and completed in December 1965. Out of the 7,417 children selected in the sample, 7,119 or 96 percent were examined.

This national sample of examinees is closely representative of the roughly 24 million noninstitutionalized children 6-11 years of age in the United States with respect at least to age, sex, race, region, size of place of residence, and rate of change in size of place of residence from 1950 to 1960.

During his single visit to the mobile units specially designed for use in the survey, each child was given a standardized examination by the examining team. Prior to this examination, information about or related to the child was obtained from one of his parents. This included demographic and socioeconomic data on household members as well as medical history, behavioral, and related data on the child to be examined. Ancillary data for the child on grade placement, teacher's ratings of his behavior and adjustment, and health problems of the child known to the teacher were requested from the school he attended. A birth certificate for each child was obtained for verification of his age and information related to him at birth.

Statistical notes on the survey design, reliability of the data, and sampling and measurement error are shown in appendix I. Definitions of the demographic and socioeconomic variables considered here are included in appendix II.

THE VISION EXAMINATION

Included in the vision examination for children in this study, as previously described,[5] were tests of color vision, monocular and binocular central visual acuity at distance and near, the degree of lateral and vertical eye muscle imbalance, bilateral accommodation, and binocularity. Except for color vision, tests were performed without glasses or other refractive lenses. Because of the small proportion of children of this age who wear glasses, no tests with correction were included.

In addition, each child was given an eye examination by a survey staff pediatrician to detect and identify disease or other eye defects.

Visual acuity for children who could read letters was tested with a commercial instrument—the Master Ortho-rater—which permitted rapid testing under controlled conditions of lighting and target distance from the examinee. The effective illumination on the target and the contrast between target letters and background were maintained within optimum limits for such tests. Special letter targets developed by Dr. Louise Sloan of the Wilmer Eye Institute, Johns Hopkins University,[6] which were used in the Ortho-rater instead of the regular targets, permitted testing at 12 levels at distance and near—10 letters of identical size per line at levels corresponding to ones from 20/12 to 20/200 and 3 letters at 20/400 (Snellen notation). The order of unserifed letters on the target which were of nearly equal legibility were randomized and differed for each line, each eye, distance, and near.

For testing children who could not read letters or were not able to do so rapidly enough to complete the test in the time limit allowed, special wall charts for distance and cards for near vision, with Landolt ring symbols instead of letters, were used. These targets contained 5 symbols per line and permitted testing at 11 levels. In previous research Sloan had found the two forms of the acuity test—the letter and the Landolt ring targets as used in this study—to be essentially equivalent.[7,8] The degree of comparability of the various specific acuity levels used in the present study for readers and nonreaders was described previously.[5]

The acuity level for the child as determined here was that corresponding to the line with the smallest sized letters or symbols he was able to read with no more than the allowable number of errors. To be considered able to read a particular line, no more than three letters on lines of 10 could have been misread, no more than one symbol on lines of 5 and no misses were allowed on lines of 3 letters.

Vision tests were administered by the survey staff examining dentist because that member of the examining team had time available to do this. Each of the five dentists employed during the cycle was given special training and practice in vision testing techniques, which had been recommended by the consultants in Ophthalmology to the survey, to insure the consistency of test results.

The testing order of right eye, left eye, and binocular vision was maintained throughout the study with the sequence of near and distance tests alternated for successive examinees as a further safeguard to minimize the effects of fatigue and learning.

Findings in this study among the various demographic and socioeconomic subgroups considered here are limited to binocular visual acuity at dis-

tance and near without correction. Acuity levels are shown in Snellen notation where the numerator of the ratio shows the distance of the target from the eye(s) of the examinee (simulated in feet for distance vision and inches for near vision) and the denominator the distance at which the particular test line would need to be for someone with "normal" vision to be able to read it correctly, with no more than the allowable number of errors specified above. In this notation 20/20 and 14/14 are usually considered normal for distance and near vision, respectively.

FINDINGS

Among all noninstitutionalized children 6-11 years of age in the United States, nearly three-fourths or an estimated 19.5 million were found to have at least "normal" or better than "normal" binocular distance vision without correction (20/20 or better).[5] The proportion reaching similar levels at near was only slightly less.

The proportion with defective binocular distance vision showed a remarkably consistent increase with age from 7 percent testing no better than 20/40 at age 6 years to 17 percent at age 11 years. The age trend for those with more seriously defective vision is even more pronounced. Among those testing no better than 20/100, the proportion increases consistently and steadily from less than 1 percent at age 6 years to nearly 8 percent at age 11 years. A similar trend with age is not found for those with defective binocular near vision, where the proportion varies between 5 and 7 percent testing no better than 14/28 over the age range in the study.

Boys were found to have slightly but significantly better binocular visual acuity at both distance and near than girls.

Race

The distribution of uncorrected distance and near binocular visual acuity among white and Negro children 6-11 years of age is generally similar (figure 1 and tables 1 and 2). Findings for the other racial groups are not included because the combined group is so small and heterogeneous that estimates for it could not be considered reliable with the size and design of the sample used in the present study.

At distance, 75 percent of the white and 73 percent of the Negro children were found to have at least normal vision of 20/20 or better, a difference so small that it is probably due to sampling variability alone (table 3). Slightly more white than Negro children were also found to have defective distance vision, whether those considered were the entire group testing no better than 20/40 or those with a more severe defect testing no better than 20/100. The respective rates for white and Negro children were 11 and 10 percent at levels of 20/40 or less and 4 and 2 percent at levels of 20/100 or less. The corresponding population estimates of children with these levels of visual acuity are contained in table 4.

At near, no statistically significant differences were found in the distribution of visual acuity between the two races. Slightly more white than Negro children had at least normal near vision of 14/14 or better—73 percent compared with 71 percent—while a negligibly smaller proportion of white than Negro children had defective acuity of 14/28 or less—6 percent compared with 7 percent.

White boys were found to have better visual acuity that white girls. Seventy-eight percent of these boys had at least normal acuity at distance (20/20 or better) compared with 72 percent of the girls, while at the other extreme relatively fewer boys (10 percent) than girls (12 percent) had defective distance acuity of 20/40 or less. The differences at either extreme were large enough to be statistically significant. A similar pattern of better acuity among white boys than girls is also found for near vision.

Among Negro children this pattern of sex differences in visual acuity is not found. Negro boys had slightly, but not significantly, poorer acuity than girls of the same race. Relatively fewer of these boys than girls reached the normal or better levels at distance and near and relatively more had defective acuity of 20/40 or 14/28 or less although these differences were statistically negligible.

White boys had somewhat better visual acuity than Negro boys. However, only among those with at least normal distance visual acuity and those with defective near acuity (14/28 or less) were the differences large enough to be considered statistically significant. The reverse pattern was found among

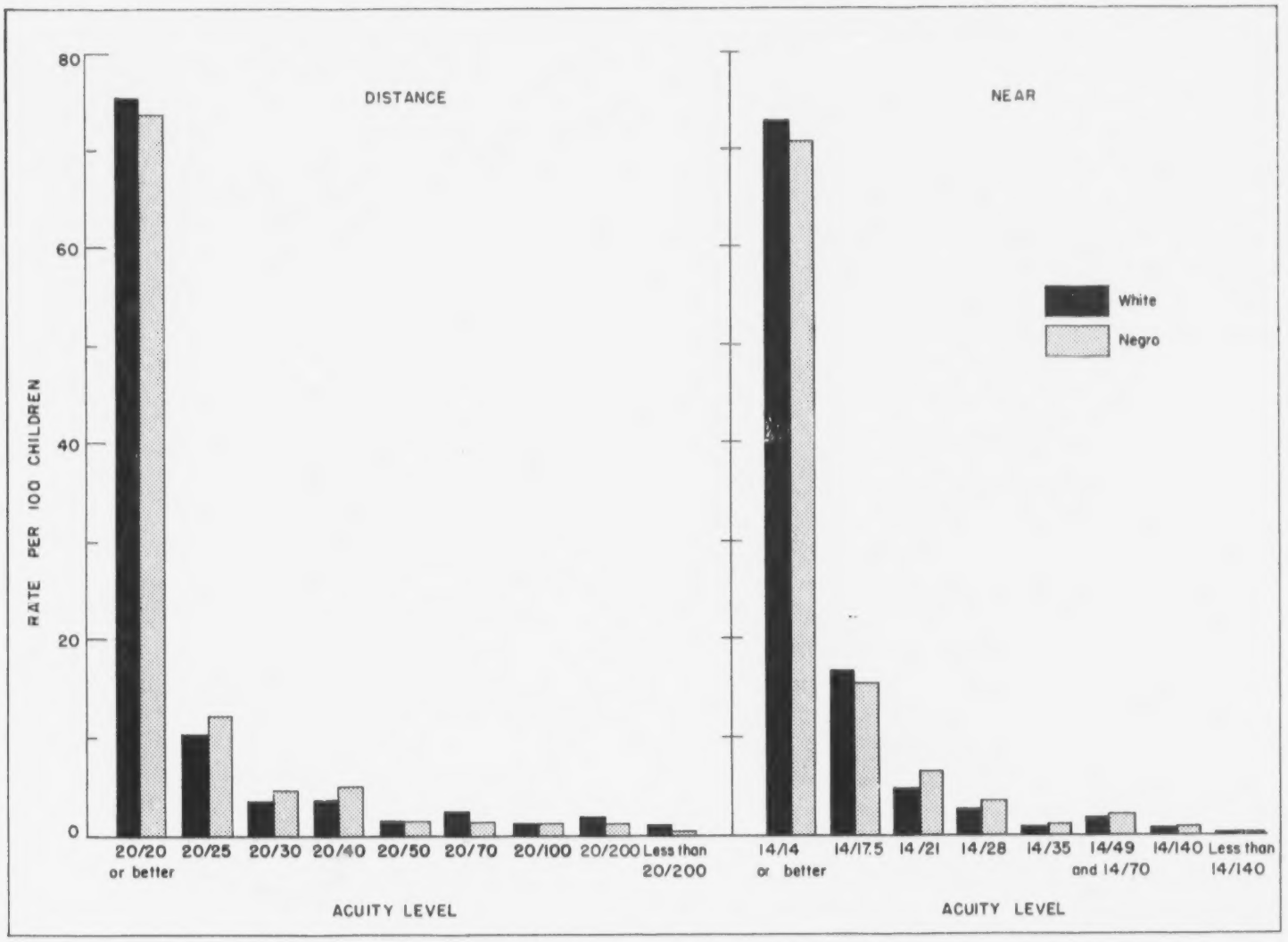

Figure 1. Number of white and Negro children per 100, 6-11 years of age, reaching specified acuity levels with uncorrected binocular distance and near vision, United States.

girls. White girls had slightly poorer acuity than Negro girls although the differences in the proportions with at least normal and with defective acuity at distance and near were not statistically significant with the size and design of the sample used in the survey.

The proportion with defective visual acuity at distance of 20/40 or less increased with age among white but not among Negro children. For white children the prevalence of this degree of visual defect more than doubled during this age span, increasing steadily from 7 percent at age 6 to 18 percent at age 11 years, with only a slight levelling off at 8 years of age. No such consistent age-related trend was found among Negro children for either distance or near vision or among white children for near vision (figure 2). This pattern was consistent for both boys and girls—the only age-related trend being the increase in the prevalence of defective distance vision among white children.

In the previous report presenting visual acuity findings among American children by age and sex[5] the effect of using two different targets—one for those who could readily read letters and the Landolt ring sets for those who could not—was assessed. It was shown that the Landolt ring symbol charts may have provided a slightly easier test than the letter targets. However, the proportion tested with these symbols was large enough only at 6 years and to a lesser extent at 7 years to have noticeably affected the overall distribution of acuity in the population under study. Because of these target differences the possible effect of any substantial differentials in letter-recognition ability between the white

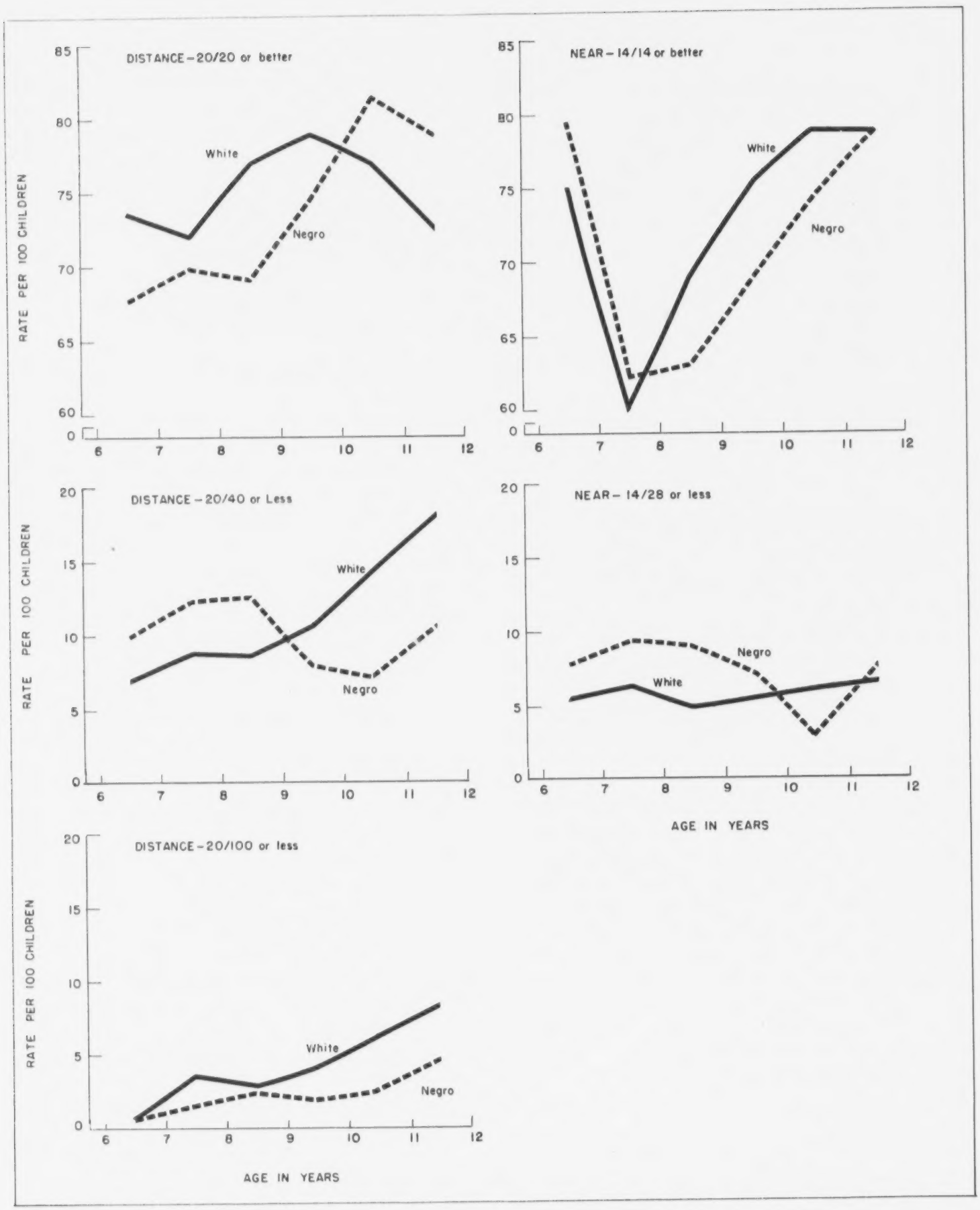

Figure 2. Number of white and Negro children per 100, reaching specified levels of uncorrected visual acuity at distance and near by age, United States.

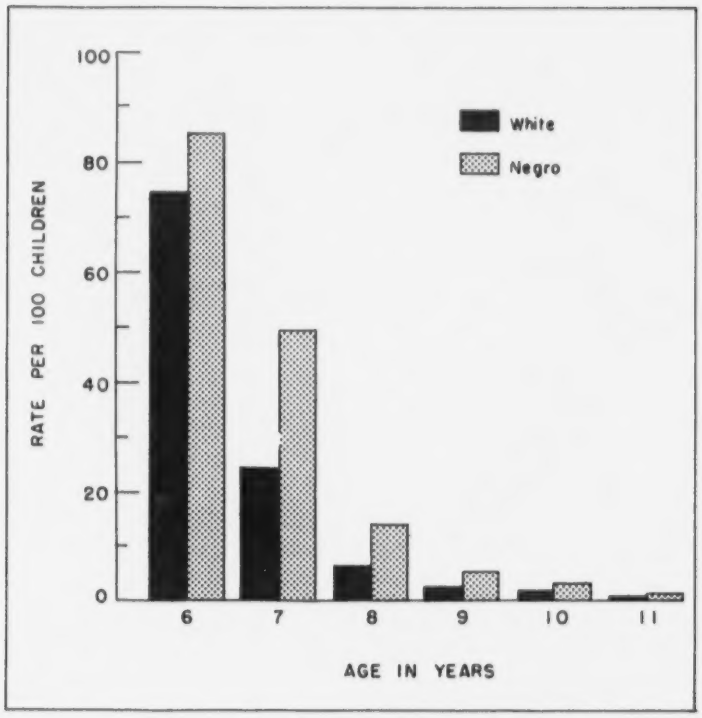

Figure 3. Number of white and Negro children per 100, tested with Landolt rings by age, United States.

and Negro groups needs to be considered. Proportionately more Negro than white children were tested with Landolt rings, 28 percent compared with 19 percent for the latter. At age 6 years nearly 86 percent of Negro children were tested with symbols compared with 75 percent of the white group. At age 7 years half of the Negro group compared with one-fourth of the white children were tested with the rings. The proportion so tested decreases rapidly with age for both groups, as shown in figure 3, until by 11 years only 1 percent of white children and less than 2 percent of Negro children were tested in this way. Thus it is apparent that at ages 6, 7, and possibly 8 years target differences could have affected the racial findings. Thus the poorer acuity levels found among Negro children under the age of 8 may actually understate the actual racial differentials in acuity for these younger children if, in fact, the Landolt ring sets did provide an easier test.

Region

Children from the South and West regions of the United States had better binocular visual acuity at both distance and near than children from the Northeast and Midwest (figure 4 and tables 5 and 6).

At distance, the prevalence of at least normal vision (20/20 or better) is significantly greater among children in the South and West (77 percent) than those in the Northeast (71 percent) but only slightly more than in the Midwest (74 percent). Defective visual acuity at levels of 20/40 or less is significantly more prevalent among children in the Northeast (14 percent) than those in the South (8 percent) and West (10 percent) but only slightly more than among children in the Midwest (12 percent).

For near vision, the prevalence of normal or better acuity (14/14 or better) is significantly greater among children in the West (78 percent) and South (76 percent) that those in the Northeast (67 percent) and Midwest (69 percent). Defective near acuity (levels of 14/28 or less) is significantly more prevalent among children in the Northeast (8 percent) than those in the South (5 percent) and West (4 percent).

In each of the regions into which the country was divided for the purposes of this survey, the prevalence of defective distance but not near vision was found to increase with age from 6 to 11 years. The sharpest rate of increase was found in the West, where the prevalence among children 11 years of ages was 4 times that for the 6-year-olds, and in the Northeast and Midwest, where the rates more than doubled in this age span. No consistent age-related trend was found for defective near visual acuity rates in any of the regions (figure 5).

Boys tended to have better visual acuity than girls in each of the four regions. The proportion with at least normal acuity at distance and near was greater among boys than girls in each region, though the differences were not consistently large enough to be considered statistically significant throughout. Defective visual acuity at distance and near was slightly more prevalent among girls than boys in each region except for distance vision in the South and West, where the rates were identical. This pattern was consistent throughout the age range in the study with few exceptions.

When compensation is made for any differences in the age distribution of these children among the four regions, the prevalence of at least normal and defective visual acuity at distance and near remains

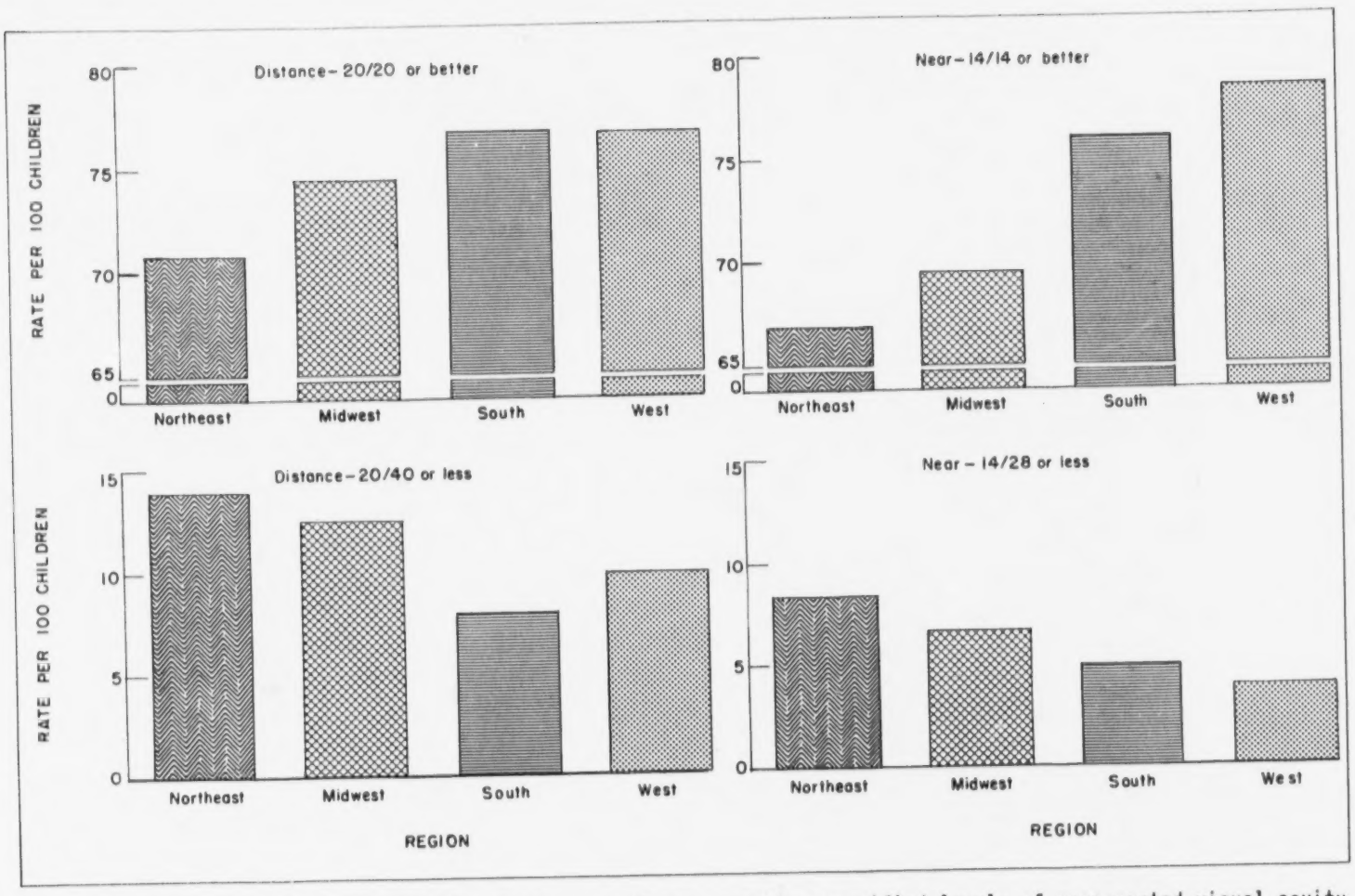

Figure 4. Number of children per 100, 6-11 years of age, reaching specified levels of uncorrected visual acuity at distance and near by region, United States.

essentially unchanged (table 7). Hence the regional differentials in these rates described above cannot be attributed to differences in age or sex distribution of children among the regions.

What racial differences were found in the prevalence of at least normal and of defective visual acuity among children 6-11 years of age in the country as a whole were not consistent in each of the four regions. Visual acuity at distance and near tended to be better among white than Negro children in the Northeast and Midwest but poorer in the South and West. However, only the differences in the prevalence rates for at least normal visual acuity at distance and near among white and Negro children in the Northeast and Midwest were large enough to be considered statistically significant at the 5-percent probability level. As apparent in table 8, the racial differences in acuity rates in the four regions were not due to differences in age distribution between the two racial groups.

Size of Place of Residence

Children from rural areas of the United States in general were found to have better visual acuity at distance and near than those who live in urban communities. The prevalence of at least normal visual acuity at distance (78 and 73 percent, respectively) and near (75 and 72 percent) is significantly greater among rural than urban residents, while the proportion with defective acuity at distance no better than 20/40 (9 and 12 percent) is significantly less (table 9).

This pattern of rural-urban differences in these acuity rates for children is consistent over the entire age range in the study, as shown in figure 6,

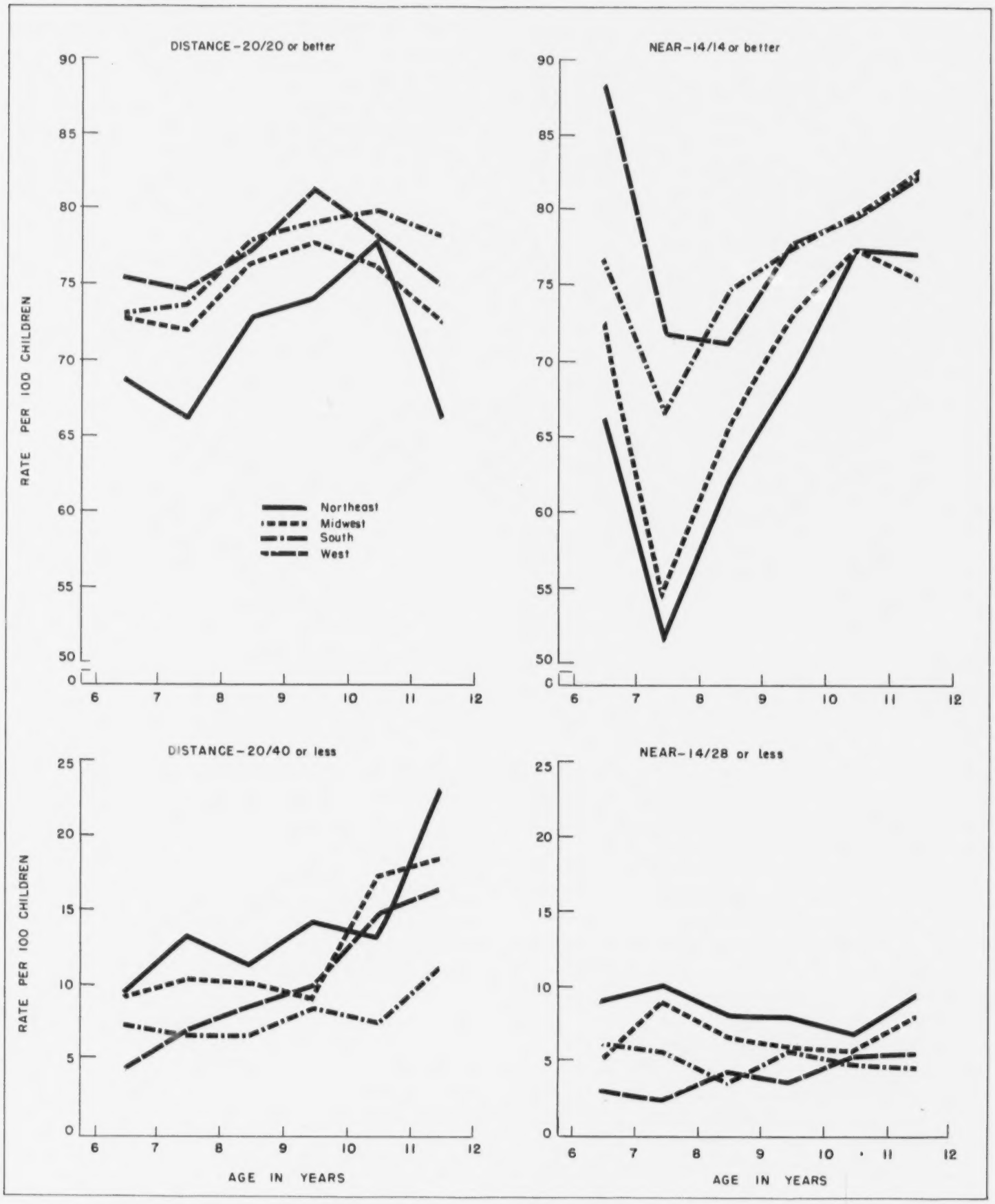

Figure 5. Number of children per 100, reaching specified levels of uncorrected visual acuity at distance and near by region and age, United States.

with one exception (age 6 for those with defective near vision) and for both boys and girls, although the differences are in general not consistently large enough to be statistically significant.

Children in large urban communities with 3 million or more population had somewhat poorer visual acuity than those in smaller urban communities. As may be seen in table 10, urban-rural and the large-small size of urban place differences in these rates are eliminated when the effect of difference in the age-sex distribution of the children in these areas is removed.

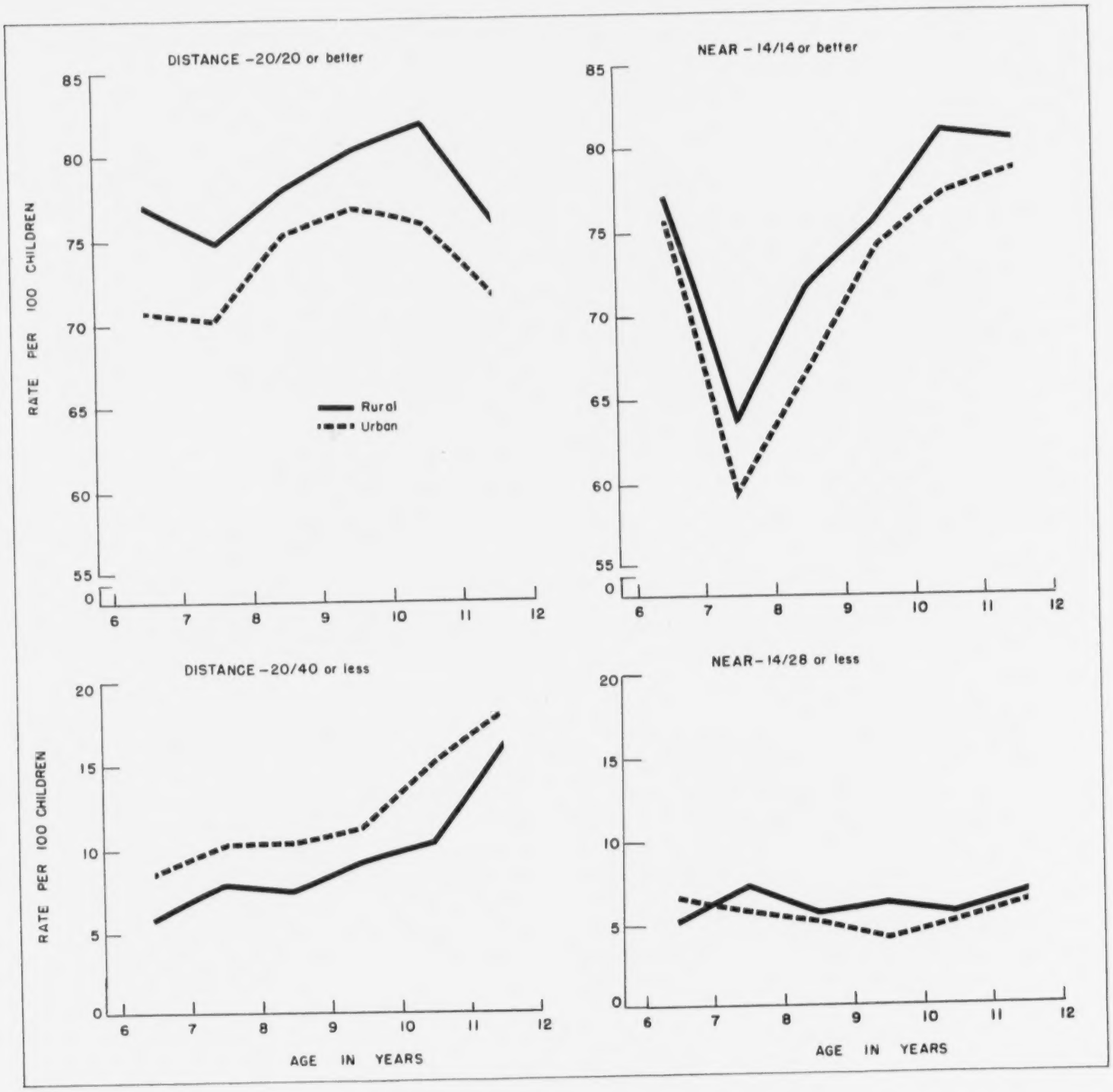

Figure 6. Number of children per 100, in rural and urban areas, reaching specified acuity levels for uncorrected distance and near vision by age, United States.

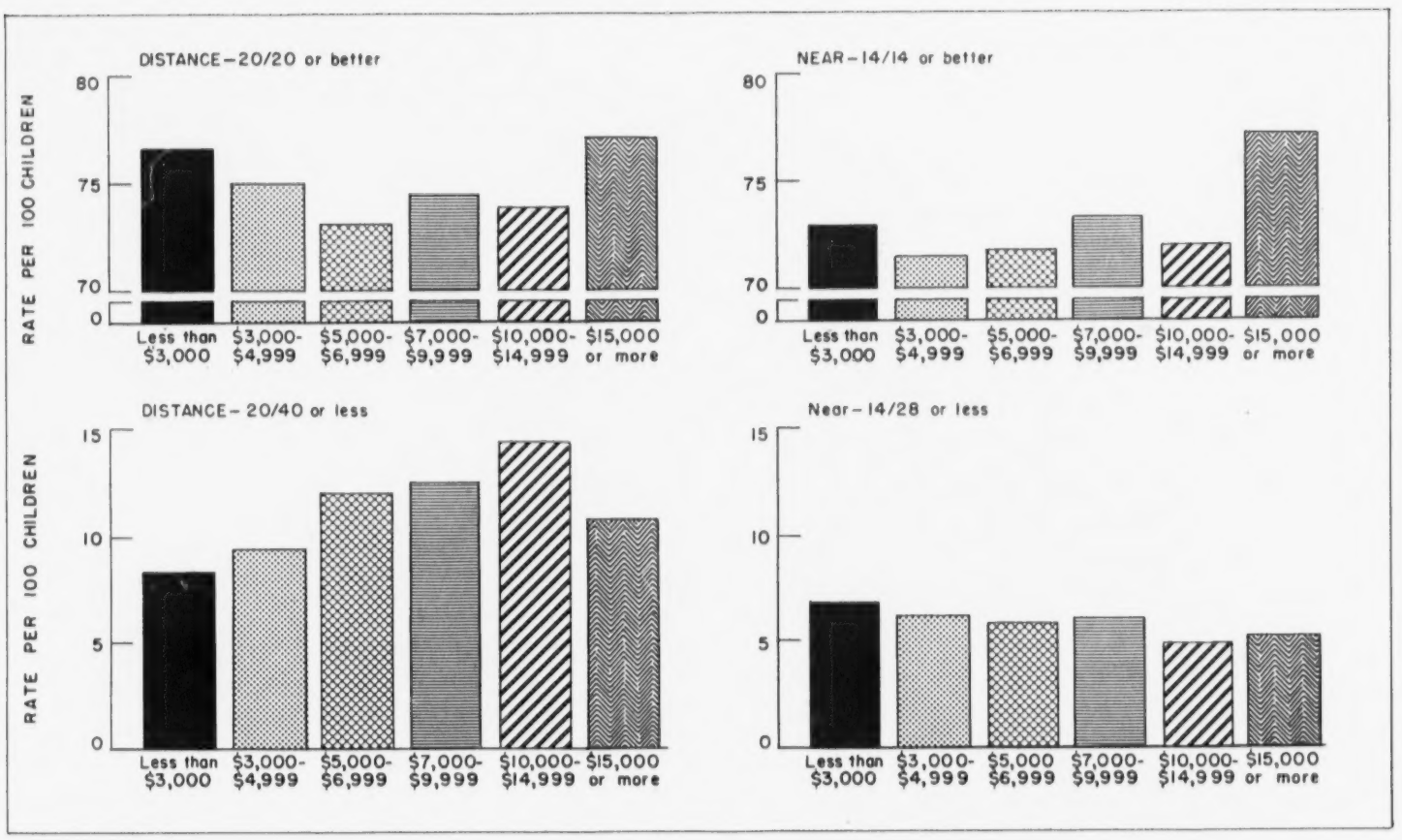

Figure 7. Number of children per 100, 6-11 years of age, with at least normal and with defective uncorrected visual acuity at distance and near by annual family income, United States.

These findings of better visual acuity among rural than among urban children are roughly consistent with those of Kephart and Unger among some 100 school children in grades 4-8 from a rural and an urban community in Indiana.[9]

Rate of Population Change.—One of the three axes of stratification used in the sampling frame for this survey was the extent and direction of change in population size of place of residence from 1950 to 1960. This was considered an index to the economic stability of the communities in which these children reside. Places showing an above-average gain in population during the decade were perhaps more likely to have a healthy expanding economy, while those experiencing a loss might tend to be communities with diminishing employment opportunities and resources for development. It might be expected that this factor would in turn be reflected to some extent in the visual acuity of the children living there insofar as this might be affected by the availability and adequacy of medical care.

No consistent pattern of relationship was found between the visual acuity of these children and this index of economic stability of their community of residence (table 11).

Family Income

Defective visual acuity at distance of 20/40 or less was found more frequently among children 6-11 years of age from families with moderate or higher incomes than for those in the lower income brackets. The proportion of children with this degree of defect increased steadily with family income from 8 percent among those with less than $3,000 per year to 14 percent among those from the $10,000-$14,999 level, then dropped off to 11 percent for children from families in the highest bracket ($15,000 or more). Only the differences in the rates among those from families with incomes under $5,000 and $5,000-$14,999 were large enough to be statistically significant at the 5-percent probability level. There was no evidence of any association between near acuity levels and family income for these children (figure 7 and table 12). The proportion with defective near acuity of 14/28 or less showed a negligible decline with income

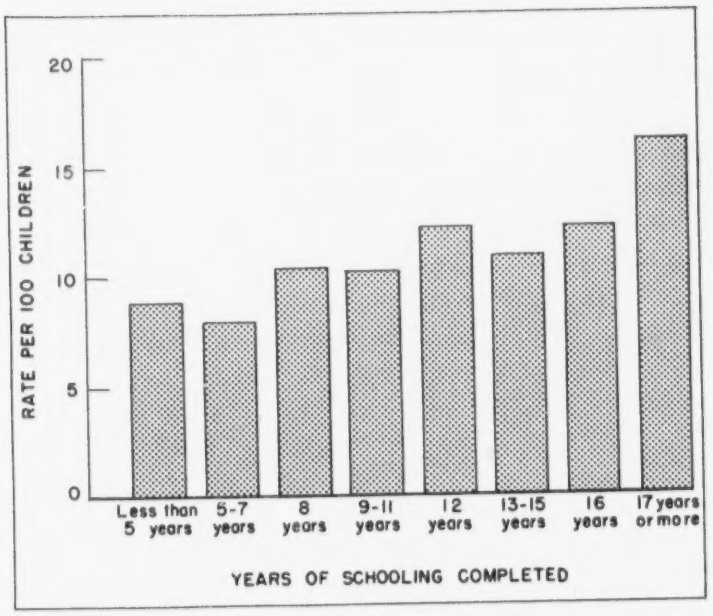

Figure 8. Number of children per 100, 6-11 years of age, with defective uncorrected distance binocular vision of 20/40 or less by education of parent, United States.

from 7 percent among families with less than $3,000 to a low of approximately 5 percent for those in the two highest income brackets.

The general increase with age in the prevalence of defective visual acuity at distance but not near for these children was found with few exceptions within each income class up to $10,000 and was present but somewhat less consistently for those from the higher income families.

Within each income class, boys tended to have somewhat better visual acuity than girls at distance and near, the differential being more marked at higher income levels of $7,000 or more.

Education of Parent

A low degree of association was also found between defective distance, but not near, visual acuity of the child and the education of the parent considered the head of the household. The proportion of children with acuity no better than 20/40 increased from 8-9 percent among those whose parent had completed less than 8 years of formal schooling to 16 percent for those whose parent had 17 years or more. Only the difference between these extremes was large enough to be considered statistically significant here (figure 8 and table 13).

In general the prevalence of defective distance, but not near, vision was found to increase with age of the children within each of the education-of-parent classes. While the progression with age was somewhat irregular over the age span in the study within most of the classes, the prevalence of this degree of visual defect (20/40 or less acuity) among 11-year-olds was more than twice that for the 6-year-olds whose parents had completed 8 years or 12 years or more formal schooling. For the remainder—those whose parents had completed 9-11 years or less than 8 years schooling—the increase was smaller but still statistically significant (46 to 78 percent more).

Grade in School

Prevalence rates for at least normal and for defective visual acuity at distance and near as described previously are shown in table 14 and figure 9 by the grade in which the children were at the time of the examination. These prevalence rates reflect the same general trends as those shown by age for these children, as would be expected since the majority of the children are in the normal grade placement for their age.

Since the age range in this survey was 6-11 years, those children in kindergarten and seventh grade are relatively smaller groups and cannot be considered typical of either the total or normal

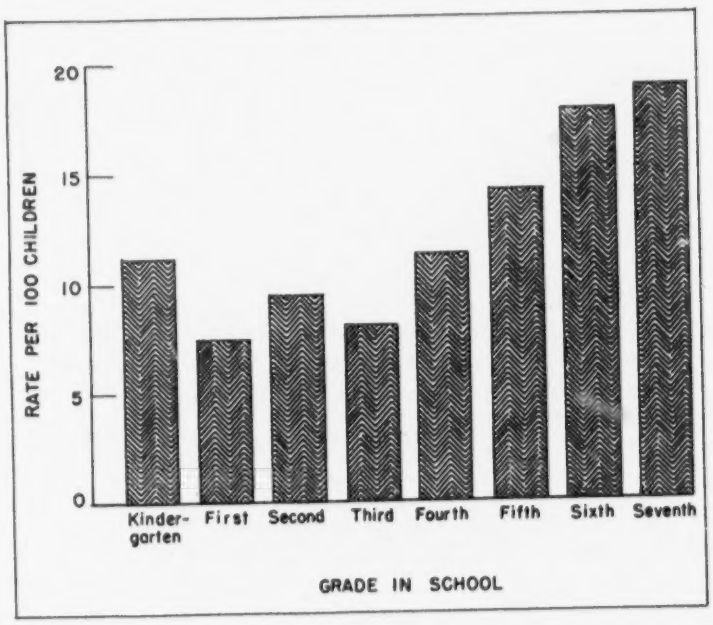

Figure 9. Number of children per 100, 6-11 years of age, with defective uncorrected distance binocular vision of 20/40 or less by grade in school, United States.

group of children in these two grades. The visual acuity findings, however, should be closely representative of noninstitutionalized children in grades 1-6.

Available previous studies among elementary school children are in general agreement with these findings showing a decrease in acuity with grade as well as with age.[10,11]

SUMMARY

This report contains estimates of the uncorrected binocular visual acuity levels at distance and near for children 6-11 years of age in the noninstitutional population of the United States in relation to their demographic and socioeconomic background. The findings are based on tests given under uniformly controlled conditions with letter targets in a commercial instrument for children who could read letters easily and with nearly comparable Landolt ring charts for those who could not.

In the Health Examination Survey program of 1963-65, a probability sample of 7,417 children was selected to represent the 24 million noninstitutionalized children of this age in the United States. Of these, the 7,119 examined, or 96 percent, were closely representative of the child population from which they were drawn with respect to age, sex, race, region, and other available demographic and socioeconomic variables.

The distribution of uncorrected distance and near binocular visual acuity among white and Negro children 6-11 years of age is generally similar. The proportion with defective distance acuity of 20/40 or less, however, increased with age among the white but not the Negro group. White boys had better visual acuity in general than white girls, while Negro boys had slightly but not significantly poorer acuity than girls of the same race.

Children from the South and West had better binocular visual acuity at distance and near than children from the Northeast and Midwest. Visual acuity at distance and near tended to be better among white than Negro children in the Northeast and Midwest but the reverse in the South and West.

Children living in rural areas of the United States in general had better visual acuity at distance and near than those who live in urban communities, irrespective of size.

The prevalence of defective acuity at distance among these children was found to be related to the education of their parents and to the size of their family income, the proportion with defective distance acuity increasing as parent's educational level or family income increased.

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Table 1. Number of white and Negro children per 100, reaching specified acuity levels for uncorrected binocular distance vision, by age and sex, with total standard error: United States, 1963-65

Race, age, and sex	20/12 or better	20/15	20/17	20/20	20/25	20/30	20/40	20/50	20/70	20/100	20/200	Less than 20/200
WHITE												
Both sexes	Rate per 100 children											
6-11 years	2.7	19.6	26.1	26.8	10.2	3.5	3.6	1.4	2.4	1.1	1.8	0.8
6 years	3.1	20.3	21.2	28.9	14.3	5.0	4.5	1.0	1.1	0.2	0.2	0.2
7 years	2.0	11.5	22.9	35.6	15.6	3.6	3.9	1.2	2.4	0.3	0.8	0.2
8 years	1.5	15.7	27.2	32.6	10.1	4.2	2.7	1.8	1.4	0.9	0.8	0.9
9 years	2.2	21.2	32.1	23.3	7.5	3.1	3.7	0.8	1.8	1.3	2.2	0.7
10 years	3.3	24.6	28.6	20.7	6.3	2.2	3.1	1.4	3.8	1.9	3.3	0.9
11 years	4.3	24.6	24.7	18.7	6.8	2.8	3.6	2.3	4.0	2.3	3.8	2.2
Boys												
6-11 years	3.8	22.0	26.5	25.6	9.1	3.0	3.4	1.3	2.1	0.9	1.6	0.6
6 years	2.5	25.4	22.9	28.3	10.4	4.1	3.8	0.6	1.3	0.3	-	0.3
7 years	2.9	12.1	24.3	32.8	15.6	3.8	3.5	1.0	2.3	0.3	1.1	0.2
8 years	2.2	19.0	26.6	31.4	9.4	3.6	3.1	2.2	1.0	0.3	0.9	0.4
9 years	2.9	24.2	31.8	23.6	6.0	2.1	3.5	0.6	1.5	1.4	1.6	0.7
10 years	5.4	27.7	28.6	18.8	6.0	1.7	2.7	1.3	3.1	1.3	2.6	0.7
11 years	6.8	23.9	25.0	17.7	6.7	2.7	3.8	2.2	3.6	2.0	3.7	1.7
Girls												
6-11 years	1.6	17.0	25.7	28.0	11.3	4.0	3.8	1.5	2.7	1.3	2.0	1.0
6 years	3.7	15.1	19.5	29.5	18.3	6.0	5.2	1.4	0.9	-	0.4	-
7 years	1.0	10.9	21.5	38.6	15.6	3.4	4.3	1.3	2.5	0.3	0.4	0.2
8 years	0.8	12.2	27.9	33.8	10.8	4.9	2.3	1.3	2.0	1.6	0.8	1.5
9 years	1.5	18.1	32.4	23.0	9.0	4.2	3.9	1.0	2.2	1.2	2.8	0.7
10 years	1.0	21.3	28.7	22.7	6.6	2.6	3.4	1.5	4.6	2.4	4.0	1.1
11 years	1.6	25.3	24.4	19.7	6.8	2.8	3.4	2.4	4.4	2.6	3.9	2.6
	Standard error											
Total	0.24	0.73	0.66	0.44	0.58	0.29	0.33	0.11	0.21	0.13	0.26	0.15
NEGRO												
Both sexes	Rate per 100 children											
6-11 years	2.5	20.2	25.0	25.6	12.2	4.4	5.0	1.3	1.3	1.1	1.1	0.3
6 years	3.0	15.4	25.4	23.7	20.2	2.3	8.7	-	-	0.6	-	-
7 years	0.4	14.9	24.1	30.3	10.7	7.3	5.6	1.9	1.3	1.2	1.6	0.5
8 years	1.4	13.7	23.3	30.6	14.0	4.4	7.4	0.5	2.2	0.4	2.1	-
9 years	-	21.4	30.3	22.8	13.6	3.9	1.4	2.8	1.9	0.5	0.5	0.8
10 years	3.9	26.2	22.0	29.4	9.0	2.3	2.1	1.6	1.1	2.4	-	-
11 years	6.7	31.3	24.7	15.8	4.5	6.2	4.3	0.6	1.2	1.7	2.2	0.7
Boys												
6-11 years	3.0	21.8	22.5	25.3	12.0	3.8	5.4	1.8	1.5	1.3	1.5	0.2
6 years	3.4	13.1	27.1	28.8	17.1	2.2	7.3	-	-	1.1	-	-
7 years	-	16.4	24.1	27.0	11.1	8.5	4.2	2.8	2.6	2.3	1.0	-
8 years	2.9	15.0	17.9	24.8	16.5	3.7	11.6	1.0	2.3	-	4.2	-
9 years	-	19.4	30.6	26.6	10.4	4.0	1.2	3.9	2.9	-	1.0	-
10 years	4.6	28.8	15.1	27.9	11.5	1.5	4.3	3.2	-	3.0	-	-
11 years	7.4	40.5	19.9	15.7	4.5	2.4	3.2	-	1.0	1.2	2.7	1.5
Girls												
6-11 years	2.0	18.6	27.4	25.9	12.3	5.0	4.6	0.8	1.1	0.9	0.6	0.4
6 years	2.6	17.9	23.8	18.4	23.4	2.4	10.1	1.3	-	-	-	-
7 years	0.9	13.5	24.2	33.6	10.3	6.1	7.1	1.0	-	-	2.3	1.1
8 years	-	12.3	28.7	36.4	11.5	5.1	3.2	-	2.0	0.8	-	-
9 years	-	23.5	30.0	19.1	16.8	3.8	1.6	1.6	0.8	1.0	-	1.6
10 years	3.1	23.6	28.8	30.8	6.6	3.2	-	-	2.2	1.7	-	-
11 years	6.1	22.1	29.6	16.0	4.5	10.0	5.4	1.1	1.3	2.2	1.6	-
	Standard error											
Total	0.86	1.00	1.35	1.82	0.97	0.49	0.98	0.32	0.43	0.48	0.32	0.19

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Table 2. Number of white and Negro children per 100, reaching specified acuity levels for uncorrected binocular near vision, by age and sex, with total standard error: United States, 1963-65

Race, age, and sex	14/14 or better	14/17.5	14/21	14/28	14/35	14/49 and 14/70	14/140	Less than 14/140
WHITE								
Both sexes	Rate per 100 children							
6-11 years	72.9	16.7	4.6	2.7	0.7	1.5	0.5	0.2
6 years	75.2	14.9	4.5	3.2	0.6	1.2	0.2	0.1
7 years	60.5	26.0	7.1	3.4	0.9	1.5	0.5	0.1
8 years	69.0	20.9	5.2	1.8	0.6	1.0	0.7	0.8
9 years	75.5	16.0	3.2	2.7	0.9	1.0	0.6	0.1
10 years	78.9	11.1	4.1	3.0	0.5	1.7	0.7	0.1
11 years	78.8	11.1	3.5	2.4	0.8	2.9	0.4	0.2
Boys								
6-11 years	76.0	14.4	4.9	2.0	0.6	1.4	0.5	0.2
6 years	79.6	11.4	4.0	3.0	0.5	0.9	0.5	0.2
7 years	63.8	22.8	9.0	2.2	0.5	1.2	0.4	0.2
8 years	72.0	19.1	5.4	1.4	0.5	0.8	0.6	0.2
9 years	78.5	13.8	3.8	1.9	0.5	0.5	0.8	0.2
10 years	82.3	9.9	3.4	1.8	0.5	1.9	0.3	-
11 years	80.4	9.0	3.9	1.8	1.1	3.1	0.3	0.3
Girls								
6-11 years	69.6	19.2	4.3	3.5	0.8	1.7	0.5	0.3
6 years	70.7	18.4	5.1	3.4	0.8	1.6	-	-
7 years	57.2	29.3	5.2	4.5	1.4	1.9	0.6	-
8 years	65.8	22.7	5.0	2.3	0.8	1.1	0.8	1.5
9 years	72.4	18.2	2.5	3.6	1.3	1.5	0.5	-
10 years	75.4	12.4	4.8	4.2	0.4	1.5	1.1	0.2
11 years	77.1	13.1	3.1	2.9	0.5	2.7	0.4	0.2
	Standard error							
Total	0.78	0.54	0.35	0.21	0.13	0.22	0.08	0.07
NEGRO								
Both sexes	Rate per 100 children							
6-11 years	70.8	15.3	6.5	3.5	1.0	2.0	0.7	0.2
6 years	79.2	10.4	2.4	5.0	1.8	1.2	-	-
7 years	62.0	20.8	7.7	2.7	1.7	2.7	1.1	1.2
8 years	62.8	18.4	9.9	2.9	1.8	2.9	1.4	-
9 years	68.9	14.4	9.6	4.5	-	1.8	0.8	-
10 years	74.2	17.3	5.8	1.9	0.7	-	-	-
11 years	78.6	10.1	3.7	3.9	-	3.1	0.6	-
Boys								
6-11 years	70.2	15.7	6.0	3.0	1.1	3.1	0.6	0.2
6 years	80.9	10.8	-	5.3	1.9	1.1	-	-
7 years	61.3	23.6	5.3	2.3	1.0	5.3	-	1.2
8 years	51.8	18.7	14.2	3.2	3.5	5.8	2.8	-
9 years	72.0	14.2	11.2	1.6	-	1.0	-	-
10 years	74.7	18.3	4.3	2.7	-	-	-	-
11 years	82.1	8.0	0.8	2.4	-	5.4	1.2	-
Girls								
6-11 years	71.4	14.9	7.1	4.0	0.9	0.8	0.7	0.2
6 years	77.5	9.9	4.9	4.7	1.7	1.3	-	-
7 years	62.8	18.0	10.2	3.2	2.4	-	2.3	1.1
8 years	73.7	18.1	5.6	2.6	-	-	-	-
9 years	65.8	14.6	8.0	7.4	-	2.6	1.6	-
10 years	73.8	16.4	7.3	1.0	1.4	-	-	-
11 years	75.0	12.1	6.5	5.4	-	0.9	-	-
	Standard error							
Total	2.01	1.22	0.93	0.66	0.44	0.42	0.30	0.14

Table 3. Number of white and Negro children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by age and sex, with total standard error: United States, 1963-65

Age and sex	Distance acuity level						Near acuity level			
	20/20 or better		20/40 or less		20/100 or less		14/14 or better		14/28 or less	
	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro
	Rate per 100 children									
Both sexes										
6-11 years	75.1	73.3	11.2	10.1	3.8	2.5	72.9	70.8	5.8	7.3
6 years	73.5	67.7	7.1	9.9	0.5	0.6	75.2	79.4	5.4	8.0
7 years	72.0	69.9	8.8	12.2	1.2	3.4	60.5	62.2	6.4	9.4
8 years	77.1	69.2	8.6	12.6	2.7	2.5	69.0	62.9	4.9	9.0
9 years	78.9	74.7	10.6	7.9	4.2	1.8	75.5	69.0	5.4	7.1
10 years	77.2	81.5	14.4	7.2	6.0	2.4	78.9	74.4	5.9	2.6
11 years	72.3	78.8	18.2	10.7	8.3	4.6	78.8	78.8	6.6	7.7
Boys										
6-11 years	77.8	72.6	10.0	11.7	3.2	3.0	76.0	70.2	4.6	8.0
6 years	79.1	72.4	6.3	8.4	0.6	1.1	79.6	80.9	4.9	8.3
7 years	72.1	67.4	8.5	13.0	1.6	3.3	63.8	61.3	4.4	9.9
8 years	79.2	60.6	7.8	19.2	1.6	4.2	72.0	51.8	3.5	15.3
9 years	82.6	76.6	9.4	9.1	3.8	1.0	78.5	72.0	3.9	2.6
10 years	80.5	76.4	11.8	10.6	4.6	3.0	82.3	74.7	4.5	2.7
11 years	73.5	83.4	17.1	9.6	7.5	5.4	80.4	82.1	6.6	9.0
Girls										
6-11 years	72.4	74.1	12.3	8.6	4.3	2.0	69.6	71.4	6.9	6.6
6 years	67.7	62.7	7.9	11.5	0.4	-	70.7	77.5	5.8	7.7
7 years	71.9	72.2	9.0	11.4	0.8	3.4	57.2	62.8	8.4	8.9
8 years	74.8	77.4	9.5	6.0	3.9	0.8	65.8	73.7	6.5	2.6
9 years	75.0	72.6	11.8	6.7	4.7	2.7	72.4	65.8	6.9	11.6
10 years	73.7	86.3	17.0	3.9	7.5	1.7	75.4	73.8	7.4	2.5
11 years	71.0	73.8	19.3	11.7	9.1	3.9	77.1	75.0	6.6	6.3
	Standard error									
Both sexes	0.90	1.66	0.56	0.97	0.38	0.59	0.78	2.01	0.40	0.81
Boys	1.23	2.81	0.82	1.94	0.44	1.01	1.04	2.90	0.54	1.49
Girls	0.85	2.13	0.71	1.03	0.58	0.77	1.07	1.43	0.64	0.77

Table 4. Number of white and Negro children with specified levels of normal or defective uncorrected binocular distance and near vision, by age and sex: United States, 1963-65

Age and sex	Distance acuity level						Near acuity level			
	20/20 or better		20/40 or less		20/100 or less		14/14 or better		14/28 or less	
	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro
	Number in thousands									
Both sexes										
6-11 years	15,332	2,399	2,279	331	768	82	14,869	2,317	1,174	240
6 years	2,581	386	249	56	18	3	2,640	451	188	46
7 years	2,519	398	306	70	43	19	2,116	354	223	53
8 years	2,630	387	294	71	93	14	2,354	352	168	50
9 years	2,676	398	358	42	143	10	2,562	368	182	38
10 years	2,565	431	478	38	201	13	2,623	393	197	14
11 years	2,361	399	594	54	270	23	2,574	399	216	39
Boys										
6-11 years	8,088	1,192	1,045	192	335	49	7,897	1,154	482	132
6 years	1,414	209	112	24	11	3	1,423	234	88	24
7 years	1,284	193	151	37	29	9	1,135	175	79	28
8 years	1,378	170	136	54	27	12	1,251	145	60	43
9 years	1,429	206	162	24	65	3	1,359	194	68	7
10 years	1,362	202	200	28	78	8	1,392	197	77	7
11 years	1,221	212	284	25	125	14	1,337	209	110	23
Girls										
6-11 years	7,244	1,207	1,234	139	433	33	6,972	1,163	692	108
6 years	1,167	176	137	32	7	-	1,217	218	99	22
7 years	1,235	205	155	32	14	10	981	178	144	25
8 years	1,252	218	158	17	65	2	1,102	207	108	7
9 years	1,247	192	196	18	78	7	1,204	174	114	31
10 years	1,203	229	278	10	123	4	1,231	196	120	7
11 years	1,140	187	310	30	146	10	1,237	190	107	16

Table 5. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by region, age, and sex, with total standard error: United States, 1963-65

Age and sex	20/20 or better				20/40 or less			
	North-east	Mid-west	South	West	North-east	Mid-west	South	West
	Rate per 100 children							
Both sexes								
6-11 years	70.8	74.5	76.8	76.7	13.8	12.5	7.9	9.9
6 years	68.7	73.1	73.1	75.4	9.4	9.1	7.3	4.3
7 years	66.3	72.0	73.6	74.6	13.2	10.4	6.7	6.7
8 years	72.8	76.3	77.7	77.1	11.2	10.2	6.4	8.5
9 years	74.5	77.6	79.1	81.0	14.2	9.1	8.5	10.0
10 years	77.9	76.1	79.9	77.9	13.1	17.4	7.2	14.8
11 years	66.1	72.6	78.3	74.9	23.2	18.6	11.2	16.3
Boys								
6-11 years	74.0	77.6	77.6	78.5	12.4	10.6	7.8	10.1
6 years	78.0	80.2	77.2	77.6	7.1	3.6	7.6	7.9
7 years	66.7	72.1	70.5	75.8	11.8	10.7	6.4	7.4
8 years	73.2	75.4	77.8	79.1	10.8	10.9	6.4	9.0
9 years	76.6	82.9	81.9	83.4	13.4	7.9	7.8	8.3
10 years	80.3	78.3	81.3	80.8	10.7	14.2	6.6	13.4
11 years	68.7	76.8	77.4	75.0	21.1	15.8	12.6	15.1
Girls								
6-11 years	67.7	71.4	76.0	74.7	15.3	14.4	8.0	9.7
6 years	59.4	65.5	68.2	73.3	11.7	14.6	6.9	1.0
7 years	65.8	71.8	76.4	72.5	14.4	10.1	7.0	5.5
8 years	72.3	77.1	77.4	74.6	11.5	9.3	6.5	7.9
9 years	72.1	72.1	76.0	78.1	15.0	10.2	9.2	11.8
10 years	74.6	73.4	78.6	75.0	16.0	21.1	7.7	16.2
11 years	63.2	68.2	78.9	74.4	25.4	21.4	10.0	17.7
	Standard error							
Total	1.29	2.88	1.65	1.80	1.41	1.37	0.52	1.48
Boys	2.71	3.49	1.86	1.88	2.31	2.00	1.11	1.83
Girls	1.28	2.69	1.87	1.81	1.90	1.49	0.66	1.62

Table 5. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by region, age, and sex, with total standard error: United States, 1963-65

20/100 or less				14/14 or better				14/28 or less			
North-east	Mid-west	South	West	North-east	Mid-west	South	West	North-east	Mid-west	South	West
Rate per 100 children											
4.4	4.3	1.9	3.6	66.6	69.4	76.0	78.5	8.4	6.6	4.9	3.9
1.3	0.3	0.2	0.2	66.0	72.4	76.5	87.9	9.0	5.1	6.0	3.0
2.5	1.7	1.3	0.7	51.9	54.4	66.4	71.7	9.9	8.9	5.5	2.4
3.4	3.9	1.4	1.8	62.0	65.7	74.7	71.1	7.8	6.4	3.4	4.2
5.5	3.5	2.5	4.2	69.2	73.0	77.2	77.8	7.7	5.7	5.5	3.4
3.5	7.3	2.4	8.3	77.2	77.2	79.6	79.4	6.6	5.4	4.7	5.3
11.1	9.2	4.0	6.9	76.8	75.2	82.2	81.9	9.3	8.1	4.4	5.3
4.6	3.5	1.7	3.0	71.9	72.1	76.8	80.4	7.0	5.7	4.3	3.5
1.9	-	0.5	0.5	76.2	75.7	78.2	89.2	6.7	4.9	5.5	4.6
3.2	1.9	1.2	1.2	55.6	57.1	67.6	72.7	9.1	6.3	4.3	1.7
2.1	2.6	1.2	1.7	66.4	63.1	74.2	74.1	6.9	5.5	3.4	4.6
5.7	3.8	1.9	2.2	75.4	77.0	77.6	81.2	4.5	4.5	4.5	1.3
1.9	5.2	2.5	7.2	79.9	79.4	81.3	85.0	4.3	5.1	3.0	4.3
13.3	7.3	3.4	5.3	78.1	80.2	82.8	81.7	10.7	7.9	5.0	4.4
4.2	5.2	2.1	4.3	61.3	66.7	75.2	76.3	9.8	7.6	5.6	4.4
0.7	0.7	-	-	55.9	68.7	74.3	86.5	11.3	5.4	6.5	1.5
1.8	1.4	1.3	-	48.2	51.9	65.0	70.0	10.7	11.1	6.6	3.5
4.5	5.3	1.5	2.0	58.3	68.3	75.2	67.6	8.5	7.3	3.5	3.6
5.3	3.3	3.0	6.4	62.5	68.9	76.6	76.1	11.1	6.8	6.5	5.6
5.6	9.7	2.2	9.3	73.5	74.5	78.0	74.0	9.5	5.7	6.2	6.2
8.8	11.1	4.4	8.9	75.4	70.1	81.6	82.0	7.7	8.2	3.8	6.5
Standard error											
0.89	0.49	0.34	1.11	1.32	2.24	1.77	1.60	1.19	0.69	0.48	0.87
1.13	1.20	0.42	0.74	2.70	2.70	2.13	1.81	1.98	1.23	1.02	0.49
1.00	0.71	0.54	1.81	1.77	2.19	1.81	2.23	1.65	1.02	0.71	1.32

Table 6. Number of children with specified levels of normal or defective uncorrected binocular distance vision, by region, age, and sex: United States, 1963-65

Age and sex	20/20 or better				20/40 or less				20/100 or less			
	North-east	Mid-west	South	West	North-east	Mid-west	South	West	North-east	Mid-west	South	West
	Number in thousands											
Both sexes												
6-11 years---	3,796	5,041	4,417	4,534	742	844	455	587	236	293	111	212
6 years----------	665	758	737	816	92	94	74	46	12	3	3	3
7 years----------	613	865	730	717	122	125	67	64	23	20	12	7
8 years----------	696	846	681	802	107	113	57	88	33	43	12	19
9 years----------	679	885	779	741	130	104	84	92	50	40	24	38
10 years---------	603	887	748	769	101	203	67	147	27	85	22	82
11 years---------	540	800	742	689	190	205	106	150	91	102	38	63
Boys												
6-11 years---	1,979	2,660	2,231	2,439	331	365	226	315	122	120	50	92
6 years----------	375	425	425	405	34	19	42	41	9	-	3	3
7 years----------	298	412	349	426	53	61	32	42	14	11	6	7
8 years----------	316	444	357	433	47	65	29	49	9	15	6	9
9 years----------	357	471	411	398	63	45	39	40	27	21	9	11
10 years---------	346	486	347	390	46	88	28	65	8	33	11	35
11 years---------	287	422	342	387	88	87	56	78	55	40	15	27
Girls												
6-11 years---	1,817	2,381	2,186	2,095	411	479	229	272	114	173	61	120
6 years----------	291	333	312	411	57	75	32	5	3	3	-	-
7 years----------	315	453	381	291	69	64	35	22	9	9	6	-
8 years----------	380	402	323	369	61	48	27	39	24	28	6	9
9 years----------	322	414	369	343	67	59	45	52	24	19	15	28
10 years---------	256	401	400	379	55	115	39	82	19	53	11	47
11 years---------	253	378	401	302	102	118	51	72	35	61	23	36

Table 7. Actual and expected number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by region and sex: United States, 1963-65

Acuity level and sex	Actual				Expected[1]			
	Northeast	Midwest	South	West	Northeast	Midwest	South	West
	Rate per 100 children							
20/20 or better								
Both sexes	70.8	74.5	76.8	76.7	74.7	74.8	74.8	74.8
Boys	74.0	77.6	77.6	78.5	77.1	77.1	77.1	76.9
Girls	67.7	71.4	76.0	74.7	72.4	72.5	72.5	72.4
20/40 or less								
Both sexes	13.8	12.5	7.9	9.9	10.9	11.1	11.1	11.0
Boys	12.4	10.6	7.8	10.1	10.2	10.3	10.1	10.3
Girls	15.3	14.4	8.0	9.7	11.6	12.0	12.1	11.8
20/100 or less								
Both sexes	4.4	4.3	1.9	3.6	3.5	3.6	3.6	3.5
Boys	4.6	3.5	1.7	3.0	3.2	3.2	3.1	3.2
Girls	4.2	5.2	2.1	4.3	3.8	4.1	4.2	4.0
14/14 or better								
Both sexes	66.6	69.4	76.0	78.5	72.4	72.6	72.7	72.8
Boys	71.9	72.1	76.8	80.4	75.4	75.4	75.3	75.1
Girls	61.3	66.7	75.2	76.3	69.4	69.6	70.0	70.2
14/28 or less								
Both sexes	8.4	6.6	4.9	3.9	5.9	6.0	6.0	5.9
Boys	7.0	5.7	4.3	3.5	5.1	5.1	5.1	5.1
Girls	9.8	7.6	5.6	4.4	6.8	6.9	6.8	6.7

[1]Assuming age-sex specific rates are identical in each region.

Table 8. Actual and expected number of white and Negro children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by region: United States, 1963-65

Acuity level and race	Actual				Expected[1]			
	North-east	Mid-west	South	West	North-east	Mid-west	South	West
	Rate per 100 children							
20/20 or better:								
White	71.9	75.5	76.3	76.7	70.9	74.6	76.8	76.7
Negro	63.8	66.1	78.1	79.9	70.7	74.4	76.7	76.3
20/40 or less:								
White	13.2	12.4	8.3	10.1	13.8	12.5	7.9	9.9
Negro	16.8	13.5	6.8	7.8	14.2	12.5	7.8	9.8
20/100 or less:								
White	4.4	4.3	2.1	3.9	4.4	4.3	2.0	3.6
Negro	4.7	5.0	1.4	-	4.6	4.3	1.8	3.5
14/14 or better:								
White	67.9	70.2	75.2	78.5	66.6	69.4	76.0	78.5
Negro	57.7	60.9	77.9	77.8	66.8	69.0	75.8	78.4
14/28 or less:								
White	7.5	6.3	5.1	4.0	8.4	6.6	4.9	3.9
Negro	15.2	9.8	4.5	2.7	8.5	6.7	5.0	4.0

[1]Assuming age-sex specific rates are identical for white and Negro children.

Table 9. Number of children per 100, in urban and rural areas with specified levels of uncorrected binocular distance and near vision, by age and sex, with total standard error: United States, 1963-65

Age and sex	20/20 or better		20/40 or less		20/100 or less		14/14 or better		14/28 or less	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	Rate per 100 children									
Both sexes										
6-11 years	73.2	77.8	12.0	9.3	3.8	3.1	71.6	74.6	6.1	5.6
6 years	70.5	77.1	8.5	5.6	1.0	0.6	75.6	76.9	5.2	6.7
7 years	70.1	74.8	10.1	7.8	2.2	0.2	59.4	63.6	7.3	5.9
8 years	75.2	77.8	10.1	7.4	2.6	2.9	66.6	71.6	5.6	5.2
9 years	76.9	80.2	11.0	9.2	4.8	2.2	74.0	75.7	6.3	4.2
10 years	75.9	81.7	15.0	10.4	5.8	5.3	77.1	80.9	5.6	5.3
11 years	71.8	76.0	17.9	16.0	7.6	8.1	78.3	80.4	6.9	6.5
Boys										
6-11 years	75.2	80.7	11.2	8.3	3.7	2.2	74.7	76.6	5.1	5.1
6 years	75.1	84.9	7.0	5.8	0.6	0.8	80.8	78.6	4.7	6.8
7 years	69.9	75.0	10.1	7.2	2.6	0.4	63.8	63.3	5.2	5.2
8 years	74.9	80.1	11.2	5.8	2.4	1.0	66.1	75.7	5.9	3.5
9 years	80.9	82.3	9.9	8.2	4.4	1.6	78.4	76.9	4.0	3.3
10 years	77.0	86.5	13.8	7.0	4.8	3.6	80.1	84.2	3.9	5.1
11 years	74.7	75.3	15.7	16.7	7.7	6.2	80.0	82.7	7.0	6.8
Girls										
6-11 years	71.1	75.0	12.8	10.3	4.0	4.1	68.4	72.6	7.2	6.2
6 years	65.7	69.2	10.0	5.4	0.3	0.5	70.2	75.1	5.6	6.7
7 years	70.4	74.4	10.0	8.4	1.9	-	54.8	63.6	9.5	6.5
8 years	75.5	75.2	8.9	9.1	2.8	4.9	67.1	66.9	5.3	7.1
9 years	72.7	77.9	12.1	10.3	5.3	2.7	69.3	74.2	8.8	5.1
10 years	74.7	77.0	16.3	13.5	6.8	6.9	74.0	77.6	7.4	5.4
11 years	68.7	76.6	20.1	15.2	7.5	9.9	76.4	78.2	6.8	6.1
	Standard error									
Total	0.91	0.93	0.54	0.77	0.33	0.59	0.83	1.22	0.37	0.97

Table 10. Actual and expected number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by size of place of residence: United States, 1963-65

Acuity level and rate	Urbanized areas				Urban places outside urbanized areas			Rural areas
	3 million or more	1-2.9 million	250,000-999,999	Less than 250,000	25,000 or more	10,000-24,999	2,500-9,999	
Distance	Rate per 100 children							
20/20 or better:								
Actual	69.6	76.5	72.8	75.3	75.7	73.4	72.7	77.8
Expected[1]	74.8	74.8	74.8	75.1	74.7	75.0	74.7	74.8
20/40 or less:								
Actual	13.6	12.2	11.9	10.3	11.7	7.8	11.1	9.3
Expected[1]	10.9	11.1	11.2	11.0	10.9	11.0	11.0	11.0
20/100 or less:								
Actual	4.0	4.1	4.6	3.4	1.2	2.1	4.8	3.1
Expected[1]	3.5	3.6	3.7	3.6	3.5	3.6	3.5	3.6
Near								
14/14 or better:								
Actual	65.7	72.7	74.1	72.0	78.8	75.4	73.2	74.6
Expected[1]	72.2	72.8	72.9	73.2	72.1	73.2	72.7	72.5
14/28 or better:								
Actual	8.6	6.6	4.6	4.8	5.1	2.7	4.8	5.6
Expected[1]	6.0	5.9	5.9	5.9	5.9	5.9	6.0	6.0

[1]Assuming age-specific rates are identical for all places.

Table 11. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by rate of population change in place of residence from 1950 to 1960, age, and sex, with total standard error: United States, 1963-65

Age and sex	20/20 or better				20/40 or less			
	Rate of population change							
	Loss	Below-average gain	Average gain	Above-average gain	Loss	Below-average gain	Average gain	Above-average gain
	Rate per 100 children							
Both sexes								
6-11 years	77.0	70.8	73.7	77.6	9.3	12.3	11.6	11.0
6 years	75.1	65.6	70.7	80.5	5.9	9.3	7.4	7.3
7 years	75.1	63.5	70.9	76.2	8.1	13.7	8.3	7.6
8 years	75.8	74.1	76.2	78.2	8.9	8.6	8.6	10.6
9 years	79.7	76.6	76.4	76.8	7.6	9.4	13.1	11.2
10 years	83.8	71.6	76.0	79.4	7.8	17.7	15.7	12.8
11 years	73.1	74.8	72.5	72.6	18.2	16.1	17.9	16.4
Boys								
6-11 years	79.2	71.5	76.6	80.6	7.9	14.3	9.7	9.3
6 years	81.5	74.2	73.9	84.0	5.4	11.5	3.4	6.8
7 years	74.8	58.4	75.3	75.0	6.7	18.2	6.8	6.3
8 years	76.6	71.7	75.2	82.9	6.5	10.5	11.1	9.3
9 years	81.7	76.5	84.0	82.8	7.9	10.2	9.2	9.7
10 years	87.7	71.9	77.9	82.1	4.1	19.1	13.5	10.0
11 years	72.9	75.2	74.2	76.7	17.1	16.8	16.3	13.9
Girls								
6-11 years	74.9	70.1	70.4	74.3	10.8	10.4	13.7	12.8
6 years	68.9	58.4	66.5	76.2	6.3	7.5	12.4	7.8
7 years	75.4	68.1	65.7	77.2	9.5	9.5	10.0	8.8
8 years	75.1	75.4	77.1	73.4	11.4	6.5	5.9	11.9
9 years	77.5	76.6	68.7	75.3	7.3	8.5	16.9	12.9
10 years	80.0	71.2	74.0	76.0	11.3	16.4	18.0	16.0
11 years	72.9	74.2	70.5	68.3	19.2	15.3	19.6	18.8
	Standard error							
Total	1.76	2.38	1.46	1.16	1.11	1.33	1.27	1.30

Table 11. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision, by rate of population change in place of residence from 1950 to 1960, age, and sex, with total standard error: United States, 1963-65--Con.

20/100 or less				14/14 or better				14/28 or less			
Rate of population change											
Loss	Below-average gain	Average gain	Above-average gain	Loss	Below-average gain	Average gain	Above-average gain	Loss	Below-average gain	Average gain	Above-average gain
Rate per 100 children											
2.9	3.5	4.1	3.9	73.7	71.7	72.4	72.5	6.2	5.0	6.6	5.9
-	1.2	0.3	0.7	78.4	76.4	74.9	73.8	6.2	3.5	6.8	6.4
1.1	2.2	1.4	1.2	69.6	54.4	61.9	58.3	5.7	8.2	6.7	6.7
3.4	1.2	2.5	3.6	66.8	66.7	71.3	67.9	6.9	3.9	6.2	4.9
1.9	4.0	6.8	2.6	72.7	75.3	73.0	77.2	4.9	3.6	7.2	6.4
3.4	7.5	5.0	6.6	79.3	76.1	77.0	80.8	6.2	5.7	4.8	5.0
8.0	4.9	9.2	8.6	78.0	81.6	78.3	78.4	7.3	5.8	7.6	6.1
1.9	4.2	3.5	3.2	75.7	71.9	76.3	77.0	5.0	6.0	5.3	4.2
-	1.9	0.4	0.5	83.1	76.7	82.6	76.1	4.5	4.9	4.9	7.5
1.1	3.8	1.5	1.3	73.9	50.0	66.5	60.3	4.1	10.0	3.4	4.2
1.3	1.2	3.2	2.1	66.6	66.9	69.2	74.6	4.4	5.5	7.2	3.1
2.1	4.0	4.8	2.6	72.4	76.1	79.9	82.5	4.8	2.6	3.7	3.7
0.6	8.4	2.9	5.6	80.2	78.1	80.6	86.0	6.1	6.4	4.1	0.7
6.5	6.0	9.1	7.0	78.7	82.6	80.0	81.8	6.0	6.9	8.6	6.0
3.9	2.8	4.6	4.7	71.7	71.5	68.1	67.8	7.4	4.1	8.0	7.8
-	0.6	-	0.8	73.9	76.0	65.0	70.9	7.8	2.3	9.2	5.1
1.2	1.3	1.1	1.2	60.7	58.4	56.3	56.2	7.4	6.5	10.5	9.0
5.5	1.2	1.7	5.2	66.9	66.4	73.3	61.0	9.4	2.2	5.1	6.6
1.7	4.1	8.9	2.6	72.8	74.3	65.9	71.1	5.0	4.5	10.7	9.5
6.0	6.5	7.1	7.8	78.3	74.0	73.2	74.6	6.3	5.1	5.5	10.1
9.4	3.6	9.3	10.2	77.1	80.2	76.1	74.8	8.6	4.6	6.4	6.3
Standard error											
0.81	0.46	0.65	0.92	1.89	2.77	2.38	1.84	0.75	1.00	0.86	0.95

Table 12. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision and expected rate, by family income and age, with total standard error: United States, 1963-65

Acuity level and age	Less than $3,000	$3,000-$4,999	$5,000-$6,999	$7,000-$9,999	$10,000-$14,999	$15,000 or more
DISTANCE						
20/20 or better	Rate per 100 children					
6-11 years	76.6	75.0	73.1	74.4	73.9	77.1
6 years	75.2	69.4	71.2	76.6	68.3	76.2
7 years	74.4	71.6	71.3	70.2	69.9	80.9
8 years	75.6	73.5	73.5	78.6	81.2	72.9
9 years	76.9	81.6	72.2	77.2	82.7	81.7
10 years	80.5	78.8	78.3	73.1	79.0	77.9
11 years	77.3	77.1	73.2	70.8	62.0	76.4
20/40 or less						
6-11 years	8.3	9.4	12.0	12.5	14.4	10.8
6 years	5.1	9.9	5.9	7.4	10.6	7.7
7 years	7.6	7.9	10.6	8.8	14.7	2.0
8 years	7.7	8.6	10.7	8.1	7.9	15.2
9 years	8.9	5.5	15.5	14.2	9.7	4.8
10 years	7.6	12.3	14.2	17.3	16.0	14.8
11 years	14.2	12.7	15.9	20.2	28.2	18.1
20/100 or less						
6-11 years	2.2	2.7	4.2	4.3	5.0	3.9
6 years	-	0.8	0.6	0.7	-	-
7 years	0.8	0.9	3.0	2.3	-	-
8 years	1.9	1.7	3.2	2.2	3.7	2.8
9 years	1.3	2.4	6.4	6.3	3.0	2.1
10 years	4.0	5.4	5.9	6.2	6.8	8.2
11 years	6.2	5.7	6.5	8.4	16.1	9.5
NEAR						
14/14 or better						
6-11 years	73.0	71.5	71.8	73.3	72.0	77.3
6 years	79.6	79.2	76.9	71.8	67.9	76.0
7 years	68.2	57.9	60.0	58.8	57.3	76.9
8 years	66.0	68.3	62.7	73.0	75.8	65.0
9 years	71.1	70.0	74.7	76.5	77.0	87.1
10 years	77.6	75.7	79.1	80.1	78.9	81.1
11 years	75.5	78.8	79.7	81.2	73.6	80.8
14/28 or less						
6-11 years	6.8	6.1	5.8	6.0	4.9	5.2
6 years	6.7	8.6	4.0	5.5	5.3	1.2
7 years	7.0	7.2	7.6	6.1	5.7	1.7
8 years	6.6	4.9	6.0	4.1	4.1	6.2
9 years	5.8	5.9	4.8	8.8	2.8	3.6
10 years	6.8	5.8	5.5	5.0	2.3	7.7
11 years	7.8	4.0	6.7	6.6	9.8	10.6
TOTAL	Expected rate[1] per 100 children					
20/20 or better	74.6	74.8	74.7	74.8	75.0	74.9
20/40 or less	11.0	10.9	11.0	11.0	11.1	11.2
20/100 or less	3.6	3.5	3.6	3.6	3.7	3.7
14/14 or better	72.4	72.6	72.0	72.5	73.1	73.3
14/28 or less	6.0	6.0	6.0	5.9	5.9	5.9
TOTAL	Standard error					
20/20 or better	1.25	1.46	0.86	1.57	2.02	3.92
20/40 or less	0.83	1.05	0.74	0.90	1.30	2.34
20/100 or less	0.49	0.65	0.54	0.54	0.58	1.19
14/14 or better	1.55	1.50	1.26	1.95	1.55	3.35
14/28 or less	0.63	0.68	0.60	0.57	0.92	1.20

[1]Assuming age-sex specific rates are identical for all incomes.

Table 13. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision and expected rate, by education of parent and age, with total standard error: United States, 1963-65

Acuity level and age	Years of schooling completed							
	Less than 5 years	5-7 years	8 years	9-11 years	12 years	13-15 years	16 years	17 years or more
DISTANCE								
20/20 or better	Rate per 100 population							
6-11 years	75.2	78.0	74.6	73.2	74.8	75.0	75.3	72.6
6 years	71.4	76.6	72.1	67.9	74.2	74.4	76.0	71.7
7 years	62.7	77.6	73.7	69.8	72.2	78.1	67.0	71.9
8 years	81.0	68.6	73.7	76.7	77.7	74.1	81.2	70.4
9 years	80.2	83.8	78.1	78.2	73.5	80.8	80.4	86.0
10 years	82.6	81.1	78.6	76.0	78.3	75.4	76.2	73.0
11 years	75.3	81.8	72.4	72.2	73.4	67.5	73.0	64.4
20/40 or less								
6-11 years	8.9	8.0	10.4	10.2	12.2	10.9	12.2	16.2
6 years	7.6	4.6	7.3	10.4	7.6	5.3	6.3	5.8
7 years	14.6	7.5	6.4	9.4	8.7	7.5	8.7	17.6
8 years	4.4	13.6	9.8	7.5	9.4	4.4	10.0	16.0
9 years	6.8	6.6	8.2	9.7	13.8	13.0	9.9	7.9
10 years	5.7	7.5	10.6	9.6	15.4	19.9	21.6	22.4
11 years	13.6	7.1	18.3	15.2	19.8	19.3	18.0	27.7
20/100 or less								
6-11 years	2.5	1.9	4.2	2.5	4.4	3.9	3.7	5.4
6 years	-	-	0.8	0.4	0.9	0.8	-	-
7 years	2.3	1.0	1.6	1.3	1.9	1.2	-	3.3
8 years	3.3	3.8	4.2	1.1	2.0	2.2	1.0	8.0
9 years	2.6	-	3.4	4.6	6.2	1.5	4.0	1.5
10 years	1.0	3.1	6.0	4.2	6.9	7.5	8.0	7.9
11 years	6.2	3.2	7.8	4.1	9.8	13.0	9.8	10.8
NEAR								
14/14 or better								
6-11 years	74.3	72.9	71.4	69.7	72.8	72.3	76.5	75.9
6 years	79.4	84.8	77.2	73.9	75.1	69.6	82.9	74.3
7 years	65.8	70.9	63.3	54.0	59.6	65.5	56.2	66.6
8 years	79.2	61.6	60.2	68.4	68.4	71.5	75.1	66.1
9 years	70.7	70.2	70.7	72.1	74.3	75.5	85.1	87.8
10 years	76.2	72.2	77.0	76.1	81.5	79.1	82.4	80.7
11 years	77.3	81.3	78.6	77.1	79.8	77.7	80.5	80.4
14/28 or less								
6-11 years	6.0	7.8	6.2	6.2	5.6	5.6	4.3	5.8
6 years	2.9	7.7	7.2	6.3	6.7	3.9	1.3	2.6
7 years	10.4	7.4	6.4	9.5	5.0	2.9	5.7	7.7
8 years	3.3	12.6	6.3	4.2	4.2	5.2	2.8	8.6
9 years	8.0	4.4	4.2	5.1	6.2	6.9	5.4	5.7
10 years	4.9	7.7	7.6	4.6	3.4	11.3	3.6	4.6
11 years	5.8	6.5	5.6	7.0	8.0	3.5	7.0	6.4
TOTAL	Expected rate[1] per 100 children							
20/20 or better	74.7	75.2	74.7	74.7	74.8	74.4	74.9	75.2
20/40 or less	11.3	11.2	11.4	11.0	11.0	10.8	11.0	11.1
20/100 or less	3.7	3.8	3.9	3.5	3.5	3.3	3.6	3.7
14/14 or better	72.8	73.0	73.0	72.3	72.5	72.0	72.7	73.3
14/28 or less	6.0	5.9	6.0	6.0	5.9	5.9	5.9	6.0
TOTAL	Standard error							
20/20 or better	2.55	2.06	1.66	1.38	1.45	1.65	2.42	2.90
20/40 or less	1.77	1.21	1.16	0.87	0.83	1.60	1.84	2.62
20/100 or less	0.71	0.75	0.72	0.52	0.53	1.14	0.93	1.46
14/14 or better	3.45	1.85	1.42	1.57	1.60	1.88	2.33	3.60
14/28 or less	1.14	1.44	0.88	0.58	0.37	0.83	1.05	1.80

[1]Assuming age-sex specific rates are identical for all educational levels.

Table 14. Number of children per 100, with specified levels of normal or defective uncorrected binocular distance and near vision and expected rate, by grade in school and sex: United States, 1963-65

Acuity level and sex	Grade in school							
	Kindergarten	First	Second	Third	Fourth	Fifth	Sixth	Seventh
	Actual rate per 100 children							
20/20 or better								
Both sexes	53.3	74.0	72.6	76.7	78.1	76.7	72.2	73.7
Boys	59.5	77.5	73.4	78.3	80.0	80.7	73.9	71.9
Girls	47.0	70.1	71.8	74.9	76.3	72.5	70.7	75.0
20/40 or less								
Both sexes	11.1	7.4	9.5	8.1	11.3	14.2	17.8	18.9
Boys	11.4	6.6	9.0	8.3	10.9	11.5	16.5	19.2
Girls	10.8	8.3	10.0	7.9	11.7	17.0	18.8	18.6
20/100 or less								
Both sexes	-	0.7	1.8	2.6	3.7	6.0	8.9	7.5
Boys	-	0.8	2.1	2.3	2.8	5.0	7.6	9.9
Girls	-	0.6	1.6	3.0	4.6	7.1	10.0	5.9
14/14 or better								
Both sexes	83.8	74.7	60.7	68.3	74.5	80.1	79.3	80.5
Boys	83.5	78.2	61.4	71.7	79.0	82.6	81.4	87.0
Girls	84.0	70.8	60.0	64.7	70.0	77.6	77.4	76.2
14/28 or less								
Both sexes	5.6	5.8	6.5	5.2	5.9	5.4	6.6	7.8
Boys	9.4	5.2	5.6	4.3	4.0	4.0	6.5	9.3
Girls	1.7	6.5	7.4	6.1	7.7	6.8	6.7	6.8
	Expected rate[1] per 100 children							
20/20 or better								
Both sexes	72.5	72.5	72.8	76.0	77.3	76.7	73.7	72.7
Boys	77.9	76.5	73.9	77.2	80.0	78.7	75.5	74.7
Girls	67.0	68.2	71.8	74.6	74.6	74.6	72.0	71.4
20/40 or less								
Both sexes	7.6	8.0	9.1	9.6	11.2	13.9	16.6	17.4
Boys	6.5	7.2	8.9	9.5	10.3	12.5	15.3	16.1
Girls	8.7	8.9	9.4	9.8	12.2	15.3	17.8	18.3
20/100 or less								
Both sexes	0.5	0.8	1.7	2.9	4.3	5.9	7.4	7.8
Boys	0.7	1.0	1.8	2.4	3.7	5.0	6.7	7.2
Girls	0.4	0.6	1.6	3.5	4.9	6.8	8.1	8.3
14/14 or better								
Both sexes	75.2	72.0	64.5	69.1	74.7	77.8	78.6	78.4
Boys	79.3	75.4	67.3	71.3	77.9	80.6	80.8	80.7
Girls	71.0	68.3	61.6	66.8	71.5	74.9	76.6	76.9
14/28 or less								
Both sexes	5.8	6.0	6.4	5.6	5.6	5.8	6.5	6.7
Boys	5.4	5.3	5.1	4.8	4.2	4.9	6.5	6.9
Girls	6.2	6.7	7.6	6.5	7.0	6.7	6.6	6.6

[1] Assuming age-sex specific rate are identical for all grades.

APPENDIX I

STATISTICAL NOTES

The Survey Design

The sample design for the second cycle of the Health Examination Survey, similar to the one used for the first cycle, was that of a multistage, stratified probability sample of loose clusters of persons in land-based segments. Successive elements dealt with in the process of sampling are primary sampling units (PSU), census enumeration district (ED), segment, household, eligible child (EC), and, finally, the sample child (SC).

At the first stage, the nearly 2,000 PSU's into which the United States (including Hawaii and Alaska) has been divided and then grouped into 357 strata for use in the Current Population Survey and the Health Interview Survey were further grouped into 40 superstrata for use in Cycle II of the Health Examination Survey. The average size of each Cycle II stratum was 4.5 million persons, and all strata fell between the limits of 3.5 and 5.5 million. Grouping into 40 strata was done in a way that maximized homogeneity of the PSU's included in each stratum, particularly with regard to degree of urbanization, geographic proximity, and degree of industrialization. The 40 strata were classified into four broad geographic regions (each with 10 strata) of approximately equal population and cross-classified into four broad population density groups (each having 10 strata). Each of the 16 cells contained either two or three strata. A single stratum might include only one PSU, only part of a PSU (e.g., New York City, which represented two strata), or several score PSU's.

To take account of the possible effect that the rate of population change between the 1950 and 1960 Census might have had on health, the 10 strata within each region were further classified into four classes ranging from those with no increase to those with the greatest relative increase. Each such class contained either two or three strata.

One PSU was then selected from each of the 40 strata. A controlled selection technique was used in which the probability of selection of a particular PSU was proportional to its 1960 population. In the controlled selection an attempt was also made to maximize the spread of the PSU's among the States. While not every one of the 64 cells in the 4x4x4 grid contributes a PSU to the sample of 40 PSU's, the controlled selection technique ensured the sample's matching the marginal distributions in all three dimensions and being closely representative of all cross-classifications.

Generally, within a particular PSU, 20 ED were selected with the probability of selection of a particular ED proportional to its population in the age group 5-9 years in the 1960 Census, which by 1963 roughly approximated the population in the target age group for Cycle II. A similar method was used for selecting one segment (cluster of households) in each ED. Each of the resultant 20 segments was either a bounded area or a cluster of households (or addresses). All the children in the age range properly resident at the address visited were EC's. Operational considerations made it necessary to reduce the number of prospective examinees at any one location to a maximum of 200. The EC's to be excluded for this reason from the SC group were determined by systematic subsampling.

The total sample included 7,417 children from 25 different States in the 6-11 years age group with approximately 1,000 in each of the single years of age.

Reliability

Measurement processes employed in the survey were highly standardized and closely controlled. Of course this does not mean that the correspondence between the real world and the survey results is exact. Data from the survey are imperfect for three major reasons: (1) results are subject to sampling error, (2) the actual conduct of a survey never agrees perfectly with the design, and (3) the measurement processes themselves are inexact even though standardized and controlled.

The first report on Cycle II[4] describes in detail the faithfulness with which the sampling design was carried out. It notes that out of the 7,417 sample children the 7,119 who were examined—a response rate of 96

percent—gave evidence that they were a highly representative sample of children of this age in the noninstitutional population of the United States. The response levels for the various demographic subgroups—including those for age, sex, race, region, population density, parent's educational level, and family income—show no marked differentials. Hence it appears unlikely that nonresponse could bias the findings much in these respects.

Measures used to control the quality of data from this survey in general have been cited previously;[4] those relating specifically to the vision sections of the examination are outlined in an earlier publication of findings from this study.[5]

Data recorded for each sample child are inflated in the estimation process to characterize the larger universe of which the sample child is representative. The weights used in this inflation process are a product of the reciprocal of the probability of selecting the child, an adjustment for nonresponse cases, and a poststratified ratio adjustment which increases precision by bringing survey results into closer alignment with known U.S. population figures by color and sex within single years of age 6-11.

In the second cycle of the Health Examination Survey the sample was the result of three stages of selection—the single PSU from each stratum, the 20 segments from each sample PSU, and the sample children from the eligible children. The probability of selecting an individual child is the product of the probability of selection at each stage.

Since the strata are roughly equal in population size and a nearly equal number of sample children were examined in each of the sample PSU's, the sample design is essentially self-weighting with respect to the target population; that is, each child 6-11 years old had about the same probability of being drawn into the sample.

The adjustment upward for nonresponse is intended to minimize the impact of nonresponse on final estimates by imputing to nonrespondents the characteristics of "similar" respondents. Here "similar" respondents were judged to be examined children in a sample PSU having the same age (in years) and sex as children not examined in that sample PSU.

The poststratified ratio adjustment used in the second cycle achieved most of the gains in precision which would have been attained if the sample had been drawn from a population stratified by age, color, and sex and made the final sample estimates of population agree exactly with independent controls prepared by the Bureau of Census for the noninstitutional population of the United States as of August 1, 1964 (approximate mid-survey point), by color and sex for each single year of age 6-11. The weight of every responding sample child in each of the 24 age, color, and sex classes is adjusted upward or downward so that the weighted total within the class equals the independent population control.

Sampling and Measurement Error

In the present report, reference has been made to efforts to minimize bias and variability of measurement techniques.

The probability design of the survey makes possible the calculation of sampling errors. The sampling error is used here to determine how imprecise the survey test results may be because they come from a sample rather than from the measurements of all elements in the universe.

The estimation of sampling errors for a study of the type of the Health Examination Survey is difficult for at least three reasons: (1) measurement error and "pure" sampling error are confounded in the data—it is not easy to find a procedure which will either completely include both or treat one or the other separately, (2) the survey design and estimation procedure are complex and accordingly require computationally involved techniques for the calculation of variances, and (3) from the survey are coming thousands of statistics, many for subclasses of the population for which there are a small number of cases. Estimates of sampling error are obtained from the sample data and are themselves subject to sampling error which may be large when the number of cases in a cell is small or even occasionally when the number of cases is substantial.

Estimates of approximate sampling variability for selected statistics used in this report are presented in the detailed tables. These estimates have been prepared by a replication technique which yields overall variability through observation of variability among random subsamples of the total sample. The method reflects both "pure" sampling variance and a part of the measurement variance.

In accordance with usual practice, the interval estimate for any statistic may be considered the range within one standard error of the tabulated statistic with 68-percent confidence, or the range within two standard errors of the tabulated statistic with 95-percent confidence. The latter is used as the level of significance in this report.

An approximation of the standard error of a difference $d = x - y$ of two statistics x and y is given by the formula $S_d = (S_x^2 + S_y^2)^{1/2}$ where S_x and S_y are the sampling errors, respectively of x and y, shown in the detailed tables.

Small Categories

In some tables magnitudes are shown for cells for which the sample size is so small that the sampling error may be several times as great as the statistic itself. Obviously in such instances the statistic has no meaning in itself except to indicate that the true quantity is small. Such numbers, if shown, have been included in the belief that they may help to convey an impression of the overall story of the table.

APPENDIX II

DEMOGRAPHIC AND SOCIOECONOMIC VARIABLES AND RELATED TERMS

Age.—The age recorded for each child was the age at last birthday on the date of examination. The age criterion for inclusion in the sample used in this survey was defined in terms of age at time of interview. Since the examination usually took place 2 to 4 weeks after the interview, some of those who were 11 years old at the time of interview became 12 years old by the time of examination. There were 72 such cases. In the adjustment and weighting procedures used to produce national estimates, these 72 were included in the 11-year-old group.

Race.—Race was recorded as "white," "Negro," or "other races." The last category included American Indians, Chinese, Japanese, and all races other than white or Negro. Mexican persons were included with "white" unless definitely known to be American Indian or of another race. Negroes and persons of mixed Negro and other parentage were recorded as "Negro."

Geographic region.—For purposes of stratification the United States was divided into four broad geographic regions of approximately equal population. These regions, which correspond closely to those used by the U.S. Bureau of the Census, were as follows:

Region	*States Included*
Northeast	Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and Pennsylvania
Midwest	Ohio, Illinois, Indiana, Michigan, Wisconsin, Minnesota, Iowa, and Misscuri
South	Delaware, Maryland, District of Columbia, West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Arkansas
West	Washington, Oregon, California, Nevada, New Mexico, Arizona, Texas, Oklahoma, Kansas, Nebraska, North Dakota, South Dakota, Idaho, Utah, Colorado, Montana, Wyoming, Alaska, and Hawaii

Urban and rural areas.—The definition of urban and rural areas was the same as that used in the 1960 Census. According to this definition, the urban population was comprised of all persons living in (a) places of 2,500 inhabitants or more incorporated as cities, boroughs, villages, and towns (except towns in New England, New York, and Wisconsin); (b) the densely settled urban fringe, whether incorporated or unincorporated, of urbanized areas; (c) towns in New England and townships in New Jersey and Pennsylvania which contained no incorporated municipalities as subdivisions and had either 2,500 inhabitants or more, or a population of 2,500 to 25,000 and a density of 1,500 persons or more per square mile; (d) counties in States other than the New England States, New Jersey, and Pennsylvania that had no incorporated municipalities within their boundaries and had a density of 1,500 persons or more per square mile; and (e) unincorporated places of 2,500 inhabitants or more not included in any urban fringe. The remaining population was classified as rural.

Urban areas are further classified by population size for places within urbanized areas and other urban places outside urbanized areas.

Grade in school.—The grade that the child attended at the time of interview was used here and later verified against school records. The grade of those children on summer vacation was considered to be the grade that they would enter when school resumed.

Education of parent or guardian.—The highest grade completed in school was recorded. The only grades counted were those attended in a regular graded public or private school where persons were given formal education, whether during the day or at night and whether attendance was full or part time. A "regular" school is one which advances a person toward an elementary or high school diploma, or a college, university, or professional school degree. Education in vocational, trade, or business schools outside the regular school system was not counted in determining the highest grade of school completed.

Family income.—The income recorded was the total income of the past 12 months received by the head of the household and all other household members related to the head by blood, marriage, or adoption. This income was the gross cash income (excluding pay in kind) except in the case of a family with their own farm or business, in which case net income was recorded.

Parent.—A parent was the natural parent or, in the case of adoption, the legal parent of the child.

Guardian.—A guardian was responsible for the care and supervision of the child. He (or she) did not have to be the legal guradian to be considered the guardian for this survey. A guardianship could only exist when the parent(s) of the child did not reside within the sample household.

Head of household.—Only one person in each household was designated as the "head." He (or she) was the person who was regarded as the "head" by the members of the household. In most cases the head was the chief breadwinner of the family although this was not always true. In some cases the head was the parent of the chief earner or the only adult member of the household.

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